

SECTION K, PART 0

MARKER AND PRETRANSLATOR CLASS OF TESTS

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K0 MARKER AND PRETRANSLATOR CLASS OF TESTS

The technique used for testing in No. 5 Crossbar is the method whereby the master test frame directs other central office equipment to establish the test connection. This method makes it possible to nearly simulate the actual usage of the particular circuit under test. It also gives a good indication that the control equipment performs its normal functions.

Nearly all test connections are established by markers or transverters under control of the Master Test Control (MTC) circuit. Class-of-test, circuit selection, and direction information is set up on keys and switches at the control panel.

Marker Test - The desired marker may be made busy to service or it may be seized in competition with service calls. In either case the MTC gains access to the markers by means of a preference chain and associated multicontact relays in the Master Test Frame Connector (MTFC) circuit. Test relays are provided in the marker to give the MTC access to leads which are required for simulating the functions of connecting circuits such as connectors, trunks, registers, etc.

Three general marker test classes are provided whereby the MTC can simulate the three different types of marker seizures. Through the operation of control keys at the master test frame all possible combinations of information received by the marker from the line link, originating register, or incoming register may be set up for simulating the seizure of the marker on dial tone class calls, originating class calls, or incoming class calls.

The marker functions according to the information with which it is primed, makes the required translations, connects to line and TL, number groups, registers, and senders as required, and sets up connections through linkages as in normal service.

Assuming that complete information is set up on the various control keys and that the MTC is started, the marker completes the functions of the test as if handling a service call. At the completion of the test it disconnects and restores to normal, lighting lamps as an indication of the success or failure of the test. When the REC key is operated, all the information recorded in the marker before it released the connecting circuits is punched on a trouble record card.

Pretranslator Test - Pretranslator tests are made by seizing the pretranslator directly from the MTC. The office code to be translated by the pretranslator is set up on the A-, B-, and C- (code and number) keys of the MTC. The MTC simulates an originating register and passes the information to the pretranslator by way of the MTFC, which now simulates a pretranslator connector. The pretranslator under test translates the

code received and transmits information to the MTC. This information, which indicates how many digits, with or without station delay, a register should await before grounding a start lead for a marker, is displayed on the pretranslator test lamp on the MTC panel. The MTC also simulates various trouble conditions to make tests of the pretranslator checking features.

K0-1 USE OF CLASS-OF-TEST TABLES

The class-of-test tables shown on SFD-K002 and K003 summarizes, in tabular form, the key(s) and switch(es) used to establish a marker/pretranslator class of test. The charts are color keyed to determine key(s) or switch(es) that are associated with a specific type of test. A single line is used to separate a particular function with its associated figure, option, key, or switch. The double line within the single lines is used to separate the various options or vintages of master test control frames. The note column and sheet notes are as follows:

- (a) Note 1 indicates that all key(s) or switch(es) must be operated to make a proper test frame setup for the particular class of test. It is suggested that known working equipment be selected for test.
- (b) Note 2 indicates the key(s) or switch(es) to be operated to simulate the trouble record.
- (c) Note 3 indicates those key(s) or switch(es) used for additional marker tests but they are not necessarily required for trouble record test or simulation test.

K0-1.1 DIAL TONE CLASS OF MARKER TEST

On a dial tone class-of-marker test the MTC simulates a line on a LL and a Line Link Marker Connector (LLMC). The marker is primed with the line equipment location and other information which it would normally receive from these simulated circuits. The marker then proceeds to seize an originating register as it would in processing a service call.

When the connection is established, the marker and all established linkages release. However, information regarding the test is locked in the MTC in the form of operated relays or lighted lamps under control of the RL key. If the REC key is operated, a trouble record is taken just prior to the release of the marker.

KO-1.2 ORIGINATING CLASS OF MARKER TEST

On an originating class of marker test, the MTC circuit simulates an originating register and originating register marker connector. To perform this task, the master test frame is first primed with code and digits, originating line location, class of service, and other information which it would normally receive from an originating register. After receiving input information from the MTC, the marker proceeds to function in accordance with its translation of the information received to set up a connection.

The originating class of marker test can be used in different types of call arrangements which are listed below.

- (a) SOG - Establishes a path from the originating line location to an outgoing trunk with or without a sender attached (SFD-C810 and C811).
- (b) IAO - Establishes a path from the terminating line location to an intraoffice trunk (terminating stage) or from the originating line location to the intraoffice trunk, (originating stage) with sender attached if AMA is required.
- (c) IMG - Establishes a path from the originating line location to an intermarker group trunk with sender attached.

KO-1.3 INCOMING CLASS OF MARKER TEST

On incoming class of marker test, the MTC simulates an incoming trunk, incoming register, and incoming register marker connector. Through the operation of control key(s) and switch(es), the marker is primed with called number, trunk link location, and other information which it would normally receive from the incoming register.

The marker then functions in accordance with the information with which it is primed to establish a connection from the called line location to the TL on which the trunk is made to appear. Operation of the trunk link hold magnets is simulated.

The operation of the line hold magnet is simulated if the NTC key is not operated. If the NTC key is operated, the no-test hold magnet in the associated horizontal group is operated to extend the channel connection back to the MTC.

Once incoming class of marker test is established, other test features of the marker can be tested with various key(s) and switch(es) such as link release, reorder, double connection test, and continuity and ground tests. The PBX and EBH hunt features of PBX lines can also be performed along with PBX allotter features.

Special marker test for no-test, no-hunt, and neither no-test nor no-hunt can also be tested.

KO-1.4 PRETRANSLATOR CLASS OF TEST

Pretranslator tests are made by seizing the pretranslator directly from the MTC. The office code to be translated by the pretranslator is set up on the A-, B-, and C- key(s) or switch(es) of MTC. The MTC simulates an originating register and passes the information to the pretranslator by way of the MTFC, which now simulates a pretranslator connector. The pretranslator under test translates the code received and transmits information to the MTC. The translated information indicates the number of digits the OR should receive, if station delay is required, and if the OR should wait before grounding a start lead to seize a completing marker. This information is displayed on the pretranslator test lamp on the master test control panel. The MTC also simulates various trouble conditions to make tests of the pretranslator checking features.

KO-2 FLOWCHARTS - MARKER TIMING (K004-K006)

Timing circuits are important to the operation of the markers and an understanding of their functions will aid the craftsperson in understanding the functions of the No. 5 Crossbar system.

There are many timing circuits that handle specific jobs. These circuits are located in the markers and associated circuits. The timing circuits covered in this part of the SFD and discussed in this part of the SCD are the Work Timer (WT) and Long Delay Timer (LDT).

KO-2.1 FLOWCHART - MARKER TIMING (DT CLASS)

On dial tone class of test, the line where the subscriber appears and the LLMC are simulated by the MTC. During a service call the seizure of the CM by the LLMC releases the MAK, MCK, and MSK relays. Either of these relays will operate the TM relay to start timing.

On test calls the MC5 relay in the MTC closes a path to operate the TM relay. The TM relay starts the Overall Timer (OAT), not shown, and the WT timer.

KO-2.1.1 Work Timer (WT)

The WT timer is started when the marker is seized and is stopped when the marker is restored to normal. The timing interval is 450 to 605 milliseconds. This short timer is used to detect troubles as soon as possible in order to quickly release the marker. The WT timer is recycled as the call progresses. Operation of the WT causes the marker to take a trouble record before releasing and will be the timer that will most often generate a trouble record.

KO-2.1.2 Long Delay Timer (LDT)

If the WT designation is not punched but the LDT is punched, the DTM is delayed an excessive time while waiting to seize either a LL or a TL. On service calls normally the Short Delay Timer (SDT) will time out rather than the LDT. However, if any marker is handling a test call, only the LDT timer is used to allow a longer interval for frame seizure. This is necessary because a marker on test holds the frames to which it is connected for the duration of the test call. This may delay any other marker which is waiting for the frames being held.

Since the LFK relay causes the LDT timer to recycle, if there is an LFK punch along with an LDT punch, the timers should recycle. However, it is possible that if the LFK should come up just as the timer is timed out, the time out LDT condition would lock in and the LFK punch could appear along with the LDT punch.

If LFK is not punched but MAK1 is, this is an indication that the TLC has been seized and has operated its relays (MAK1) but that the LL has not been seized (no LFK).

If MAK1 is not punched, the interpretation of the CK punch is dependent on whether or not option ZL is provided in the DTM. This option is shown as STD (Standard) option in the operate path of the TFK1 relay (SFD-K306).

If STD option is not provided, absence of the CK punch after an LDT time out indicates a delay in seizing a TL.

If STD option is provided, the operation of the LDT relay caused by an LDT time out operates the TFK1 relay and grounds the CK lead, so that there will always be a CK punch after an LDT time out. In this case, the absence of an MAK1 punch with a CK punch indicates a delay in seizing a TL.

KO-2.2 FLOWCHART - MARKER TIMING (ORIG CLASS)

On ORIG class of test, the OR and ORMC are simulated by the MTC. During a service call the seizure of the CM by the ORMC releases the MAK, MCK, and MSK relays. Either of these relays will operate the TM relay to start timing.

On test calls the MC5 relay in the MTC closes a path to operate the TM relay. The TM relay starts the OAT, not shown, and the WT timer.

KO-2.2.1 Work Timer (WT)

The WT timer is started when the marker is seized and is stopped when the marker is restored to normal. The timing interval is 450 to 605 milliseconds. This SDT is used to detect troubles as soon as possible in order to quickly release the marker. The WT timer is recycled as the call progresses. Operation of the WT causes the marker to take a trouble record before releasing and will be the timer that will most often generate a trouble record.

KO-2.2.2 Long Delay Timer (LDT)

If the WT designation is not punched but the LDT is punched, the CM is delayed an excessive time while waiting to seize a LL, TL, or OSC. On sender calls, normally the SDT timer will time out rather than the LDT timer. However, if any marker is handling a test call, only the LDT timer is used to allow a longer interval for frame seizure. This is necessary because a marker on test holds the frames to which it is connected for the duration of the test call. This may delay any other marker which is waiting for the frames being held.

KO-2.3 FLOWCHART - MARKER TIMING (INC CLASS)

On INC class of test, the IR and IRMC are simulated by the MTC. During a service call the seizure of the CM by the IRMC releases the MAK, MCK, and MSK relays. Either of these relays will operate the TM relay to start timing.

On test calls the MC5 relay in the MTC closes a path to operate the TM relay. The TM relay starts the OAT, not shown, and the WT timer.

KO-2.3.1 Work Timer (WT)

The WT timer is started when the marker is seized and is stopped when the marker is restored to normal. The timing interval is 450 to 605 milliseconds. This short time is used to detect troubles as soon as possible in order to quickly release the marker. The WT timer is recycled as the call progresses. Operation of the WT causes the marker to take a trouble record before releasing and will be the timer that will most often generate a trouble record.

KO-2.3.2 Long Delay Timer (LDT)

IF the WT designation is not punched but the SDT or LDT is punched, the CM is delayed an excessive time while waiting to seize a LL, TL, or NG. On service calls, normally the SDT timer will time out rather than the LDT timer. However, if any marker is handling a test call, only the LDT timer is used to allow a longer interval for frame seizure. This is necessary because a marker on test or taking a trouble record holds the frames to which it is connected for the duration of the test call. This may delay any other marker which is waiting for the frames being held.

KO-3 TROUBLE ANALYSIS SEQUENCE CHART (SFD-K007-K009)

Standard sequence charts generally show a sequence of relay operation and release. All relays are shown that relate to a particular function. Trouble record punch indications are shown at the point in the sequence when ground is applied to or removed from the lead to the trouble recorder. Trouble analysis sequence charts omit relays shown on the regular sequence chart, except those relays associated with the trouble record designations (SFD-A103). A designation on the trouble analysis sequence chart without a punch symbol indicates the point in the sequence where that designation would be punched if a trouble record were taken. A designation with a triangle (base down) to its right indicates the point in the sequence after which a designation would not be punched.

The trouble analysis sequence chart, and all sequence charts, operate from the top of the page to the bottom. To identify the trouble area the reader must start at that point of major failure and back-track to the point where all punch indications (leading to the branch in trouble) are shown.

For a detailed description of the use of sequence charts and trouble analysis sequence charts the reader should turn to SCD C0-4.1.

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K1 MARKER INPUT

On a Dial Tone (DT) class of marker test the MTC simulates a line on a LL and a LLMC. The DTM is primed with the line equipment location and other information which it would normally receive from these simulated circuits. The DTM then proceeds to seize an OR as it would in processing a service call.

On an ORIG class of marker test, the MTC simulates an OR. To perform this task, the CM is first primed with code and digits, originating line location, class of service, and other information which it would normally receive from an OR. After receiving input information from the MTC, the CM proceeds to function in accordance with its translation of the information received to set up a connection.

The ORIG class of marker test can be used in different types of call arrangements which are listed below.

- (a) SOG - Establishes a path from the originating line location to an outgoing trunk with or without a sender attached.
- (b) IAO - Establishes a path from the terminating line location to an intraoffice trunk (terminating stage) or from the originating line location to the intraoffice trunk, (originating stage) with sender attached if AMA is required.
- (c) IMG - Establishes a path from the originating line location to an intermarker group trunk with sender attached.
- (d) REV - Establishes a path from the originating line location to a reverting trunk.

The ORIG class of test shown in this issue of the SFD will discuss the SOG class.

On Incoming (INC) class of marker test, the MTC simulates an incoming trunk, Incoming Register (IR), and Incoming Register Marker Connector (IRMC). Through the operation of control key(s) and switch(es), the CM is primed with called number, trunk link location, and other information which it would normally receive from the IR.

K1-1 MARKER INPUT (DT CLASS)

On a DT class of marker test the MTC simulates a line on a LL and a LLMC. The DTM is primed with the line equipment location and other information which it would normally receive from these simulated circuits. The marker then proceeds to seize an OR as it would in processing a service call.

K1-1.1 SIGNAL TO OPERATE KEY CONNECTING RELAYS

When the MTC is normal, most of the leads to the MTFC are isolated at open contacts of connecting relays (MT-). The class-of-test relays operated determine the connecting relays which will be operated to cut through leads for the test being made.

Certain test relays of the marker are operated under control of keys and these relays must be operated before the marker starts to function. A check lead loops through these relays in the DTM and relays and keys of the MTC to insure that the proper combination of relays has been operated before ground is closed to the MTC to operate the Marker Connector (MC) relay.

K1-1.2 JUNCTOR SEQUENCE (RANDOM OR SELECTED) (SFD-K104)

In order for the DTM to start its functions, the MC relay in the MTC must be operated.

K1-1.2.1 Random Junctor Sequence

For a random junctor sequence the JSQ- key or switch will be released or set in the OFF position. A path from the DTM through an MT1 and TS- (if equipped) connector relays will operate the MC relay in the MTC. The DTM may then proceed with its functions.

K1-1.2.2 Particular Junctor Sequence Selected

With the JSQ switch or JSQ- key operated to the desired junctor sequence, the operating of the TS- connecting relays causes the operated JSQ(0-5) relay of the marker to be released and the selected one to be operated. The operated KCH relay through JSQ- key or JSQ switch operates the MT8 relay in the DTM. The MT8 operates the MT8A and extends a ground to the MTC to operate the KJSQ relay in the MTC. When the JLE or JLO relay operates in the DTM, the MT8 relay releases in turn releasing the MT8A. The release of these relays extends the ground standing on the MT1 relay through keys or switches (operated or released) in the MTC through KJSQ relay in the MTC to operate the MT8K relay. The MT8K locks to the KCH relay ground and extends ground from DTM to operate the MC relay. The DTM proceeds with its function.

K1-1.3 SIMULATED FUNCTIONS OF THE LINE LINK FRAME AND LINE LINK MARKER CONNECTOR

The MC relay operates and in turn operates MC(1-8) (SFD-K104). These relays close many of the leads to the MTFC and also extend the ground from the class-of-test relays to operate the required connecting relays.

When the OC1 lead is closed through by the operation of the MC1 relay (SFD-K106), and the Vertical Group Test Check (VTK) relay has operated, the OC1 relay in the DTM is operated in series with the MS relay in the MTC. The MS relay was operated from resistance battery through a break-contact of the TC1 relay when the DT relay operated (SFD-J106,K106).

The operated MC1 closes the DTK lead to the G lead to simulate operation of the DTK relay in a line link frame (SFD-K607). The MC2 relay also extends ground to the DP, MF and MLF keys or switches (SFD-K106) which simulate the following conditions depending on which keys or switches are operated:

<u>RG Switch in Position or Key Operated</u>	<u>Simulates a Line Link Frame Having Customers Requiring Originating Registers in Register Group</u>	<u>Relays Operated in Marker</u>
DP/None	D	D
MF	MF	MF
	One or Two Register Groups Provided	
MLF	Mixed Line Link Frame	MLF, D or MF

After the OC relay in the DTM has operated (SFD-K106), it grounds the TC1 lead to operate the TC1 relay in the MTC which simulates the corresponding relay of a LLMC. Operation of the TC1 relay lights the TC1 lamp and opens the operate path of the MS relay leaving it locked in series with the OC1 relay of the DTM (SFD-J106).

K1-1.4 ORIGINATING LINE IDENTIFICATION

The MTC simulates the line location of the originating line through keys and switches operated. When the MC4 relay operates in the MTC, it operates the KVG1,2 relays. The KVG2 relay operates the KFTU, partially closes the path to the KHGT (SFD-K110) and in conjunction with the KVG1, partially closes the TVGT- leads.

K1-1.4.1 Line Link Frame Input (SFD-K108)

The KFTU relay closes the FT(0-3) leads from the FT(0-5) keys or switch and the FU0,1,2,4,7 leads from the FU(0-9) key or switch to the MTFC. The FT(0-5) key or switch operated grounds the FT leads on a 1-out-of-4 or 2-out-of-4 basis while the FU(0-9) key or switch grounds the FU leads on a 2-out-of-5 basis to transmit LL tens and units to the DTM.

If a trouble is encountered at this point in the progress of the test, the trouble record would show FT- and FU-punch information.

K1-1.4.2 Vertical Group Input (SFD-K110)

The KVG1 and KVG2 relays also close the TVGT(0-11) leads from the VG(0-11) keys or VGU switch with VGT1 key operated or released to the MTFC (SFD-K110). The grounded TVGT(0-11) lead transmits the vertical group identification of the simulated calling line. If a trouble is encountered at this point in the progress of the test, the trouble record would show VGT- punch information.

K1-1.4.3 Horizontal Group Inputs

When the DTM proceeds to the point where it would have made vertical group identification, it supplies battery on the VGA lead, operating the KHGT relay in the MTC (SFD-K110) which simulated one of the VGA(0-11) relays on a LL and closes through the THGT(0-9) leads (SFD-K112) from the HG(0-9) key or switch to the MTFC. The HG(0-9) key or switch operated grounds the corresponding THGT(0-9) lead to transmit the horizontal group identification of a simulated calling line. If a trouble is encountered at this point in the progress of the test, the trouble record would show HGT- punch information.

K1-1.4.4 Vertical File Input and Class of Service

The remaining portion of the originating line identification is the vertical file input. On DT class of test this information is supplied by the MTC after the LLC is seized and is covered in K5 part.

The class of service information may be selected by operating CS keys or CST- and CSU- switches. The operation of these keys are optional, however, and may not be operated. If the user does not operate these keys or switches the class of service information is determined when the DTM connects to the LL through the LLC.

K1-1.4.5 Preference and Lock-Out (SFD-K110, K112)

The WSD relay in the MTC was operated when the MT relay in the DTM operates (SFD-J123). When it is desirable to check the DTM junctor sequence and its ability to select proper VG and HG information, the P & LO key must be operated. The P & LO provides the DTM with an additional VG- or HG- so that two TVGT(0-11) and two THGT(0-9) leads are grounded. If the junctor sequence circuit is working correctly, the preferred VGT- and HGT- relays will remain operated and the test will proceed.

K1-1.5 MISCELLANEOUS INPUTS TO DTM (SFD-K107)

K1-1.5.1 Trouble Release

The DTM has two trouble release leads (TRL and BT) which are extended to the MTC. In general the DTM grounds the TRL lead when it expects the MTC to make a second trial and grounds the BT when it does not expect the MTC to make a second trial.

When the DTM grounds the TRL lead to give a trouble release, the TRL relay of the MTC is operated, which lights the TRL lamp and operates the MFC relay (SFD-K712).

When the DTM grounds the BT lead to give a trouble release, the BT relay of the MTC is operated, which lights the BT-OF lamp and operates the MFC relay (SFD-K712).

K1-1.5.2 Second Trial (TR2 Key Operated)

With the TR2 key normal, the TRK lead is grounded causing the DTM to function as for a first trial seizure. Operating the TR2 key grounds the TR2 lead, causing the marker to function as for a second trial seizure.

K1-1.5.3 Connector Start Transfer (TRS Key Operated)

Operating the TRS key causes the TRS lead to be grounded. The DTM recognizes this ground as a connector (simulated LLMC) start transfer signal. After setting up the required connection, the marker gives a trouble record having a TRS punch. The REC key should be normal when the TRS key is used.

K1-2 MARKER INPUT (ORIG CLASS)

On an ORIG class of marker test, the MTC simulates an OR. To perform this task, the master test frame is first primed with code and digits, originating line location, class of service, and other information which it would normally receive from an OR. After receiving input information from the MTC, the CM proceeds to function in accordance with its translation of the information received to set up a connection.

K1-2.1 SIGNAL TO OPERATE KEY CONNECTING RELAYS

When the MTC is normal, most of the leads to the MTFC are isolated at open contacts of key connecting relays (MT-). The class-of-test relays operated determine the connecting relays which will be operated to close through the MTFC.

Certain test relays of the CM are operated under control of keys for some tests and not for others. Any of these relays, which are to be operated for a test, must be operated before the marker starts to function. A check lead loops through these relays in the marker and relays, keys, and switches of the MTC to insure that the proper combination of relays has been operated before ground is closed to the MTC to operate the MC relay. When the KCH relay is operated, and a JSQ(0-5) key or switch is operated, a check is made that the junctor sequence relays at the marker have been released and reoperated under control of the JSQ(0-5) key or switch. The operation of the KJSQ relay indicates that the JSQ- relays in the marker are released, whereupon one of the JSQ- relays is operated through one of the operated JSQ(0-5) keys or switch. The operation of the MT8K relay indicates that a JSQ- relay in the marker has been operated, whereupon the MC relay can be operated.

When the signal to operate the key connecting relays is received, the MC relay of the test circuit operates and in turn operated MC(1-8). These relays close many of the leads to the MTFC and also extend the ground from the class-of-test relays to operate the required pattern of key connecting relays.

K1-2.2 JUNCTOR SEQUENCE (RANDOM OR SELECTED)(SFD-K105)

In order for the CM to start its functions, the MC relay in the MTC must be operated.

K1-2.2.1 Random Junctor Sequence

For a random junctor sequence the JSQ- key or switch will be released or set in the OFF position. A path from the CM through an MT- and TS- (if equipped) connector relays will operate the MC relay in the MTC. The CM may then proceed with its functions.

K1-2.2.2 Particular Junctor Sequence Selected

With the JSQ switch or JSQ- key operated to the desired junctor sequence, the operating of the TS- connecting relays causes the operated JSQ(0-5) relay of the marker to be released and the selected one to be operated. The operated KCH relay through JSQ- key or JSQ switch operates the MT8 relay in the CM. The MT8 operates the MT8A and extends a ground to the MTC to operate the KJSQ relay in the MTC. When the JLE or JLO relay operates in the CM, the MT8 relay releases in turn releasing the MT8A. The release of these relays extends the ground standing on the MT17 relay through keys or switches (operated or released) in the MTC through KJSQ relay in the MTC to operate the MT8K relay. The MT8K locks to the KCH relay ground and extends ground from CM to operate the MC relay. The CM proceeds with its function.

K1-2.3 ORIGINATING LINE LOCATION

The KVFl relay operates upon operation of the MC4 relay (SFD-K105). The KVFl relay operated operates the KVHG (SFD-K107) and KFTU (SFD-K108) relays. The KFTU relay extends ground from FT(0-5) keys or FT- switch to the FT(0-3) leads (SFD-K109), through the MTFC to the CM. The KFTU relay also extends ground from FU(0-9) keys or FU switch to the FU0,1,2,4,7 leads, through the MTFC to the CM. If a trouble is encountered at this point in the progress of the test, the trouble record would show FT- and FU- punches (if failure was not due to problems with these leads).

The KVHG relay extends ground from VG(0-11) keys or VGT1 key (operated or released) and VGU switch (SFD-K111) to the VG0,1,2,4,7 leads, through the MTFC to the CM. If a trouble is encountered at this point in the progress of the test, the trouble record would show VG 2-out-of-5 punches (if failure was not due to problems with these leads).

The KVHG relay also extends ground from HG0-9 keys or HG switch (SFD-K113) to the HG0,1,2,4,7 leads, through the MTFC to the CM. If a trouble is encountered at this point in the progress of the test, the trouble record would show HG 2-out-of-5 punches (if failure was not due to problems with these leads).

The KVFl relay extends ground from VF0-4 keys or VG switch (SFD-K113) to the VF0-4 leads, through the MTFC to the CM. If a trouble is encountered at this point in the progress of the test, the trouble record would show VF 1-out-of-5 punches (if failure was not due to problems with these leads).

When the GTL1 and GTL2 relays in the CM operate, the FT-, FU-, VG-, HG-, and VF- leads are extended to operate associated relays in the CM, ground FT'-, FU'-, VG'-, HG'-, and VF'- leads to the MTFC, and later in the test extend leads to OS (if AMA is required).

K1-2.4 CALLED NUMBER

The MC4 relay operates K relay (SFD-K119). The K relay closes ground from the operated A-L keys or switches operating corresponding KA-KL relays. The operated KA-KL relays extend ground from the operated A-L keys or switches to the CM (SFD-K120-K123).

The K relay also operates the K1 relay (SFD-K119). The K1 is slow operating to allow the slowest KA-KL relay to operate before continuing the function of the circuit. The operated K1 relay provides ground for a KA-KL relay contact chain (SFD-K123). The last operated KA-KL relay extends this ground to lead 7 of the next higher lettered digit as an indication to the CM that no further digits are to be expected.

K1-2.5 CLASS OF SERVICE (SFD-K125)

The KCS3 relay operates upon operation of the MC4 relays (SFD-K112). In offices having 30 classes of service maximum, the KCS3 relay extends ground from the contacts of operated CST and CSU keys or switches to the CM. In offices having 60 classes of service maximum, the KCS3 relay also closes ground to the CGA lead from the CGB key normal for the first 30 classes of service and CGB key operated for the second 30 classes of service (SFD-K125).

In offices arranged for class of service on a tens and units basis the KCS3 and KCS6 relays operate upon operation of the MC4 relay. The KCS3 relay extends ground from the contacts of operated CSU(0-9) and CST(0-9) switches to the CM(SFD-K125).

K1-2.6 MISCELLANEOUS KEYSK1-2.6.1 Second Trial (TR2 Key Operated)

With the TR2 key normal, the TRK lead is grounded causing the CM to function as for a first trial seizure. Operating the TR2 key grounds the TR2 lead, causing the marker to function as for a second trial seizure.

K1-2.6.2 Connector Start Transfer (TRS Key Operated)

Operating the TRS key causes the TRS lead to be grounded. The CM recognizes this ground as a connector (simulated ORMC) start transfer signal. After setting up the required connection the CM gives a trouble record having a TRS punch.

K1-2.6.3 Coin, Permanent Signal and Partial Dial

The KOR relay operates upon operation of the MC3 relay (SFD-K118). The KOR relay operated furnishes grounds for the 11/X11, PS/PD, and CNR/SCN keys (SFD-K124), extends the grounds from contacts of the TP and PMM keys (SFD-K125) and closes the winding of the CNR relay to the marker.

The 11/X11 key normal or TRNA switch set to LT extends ground from the KOR or MC21 relays respectfully to the LT lead to signal the CM to use its local translator.

The PS/PD key normal extends ground to the PK check lead which the CM requires if neither the PS or PD leads are grounded. The PS key operated extends ground to the PS lead to signal the CM to set up a permanent signal route.

The PD key operated extends ground to the PD lead to signal the CM to function for a partial dial. If the FACD key is normal a connection will be set up to a tone trunk. If the FACD key is operated this can be set up to a tone trunk or passed on to an intercept attendant.

The CNR/SCN key normal extends ground to the SCK check lead which is required by the CM when neither the CR nor SCN leads are grounded.

The CNR or SCN keys normally need only be operated when coin class of service has been set up and when the route for the code setup is such that the coin must be returned by the OR because the trunks for the route do not have coin features. If neither the CNR nor SCN key is operated for such a route, the CM will ground the CNR lead to operate CNR relay. The CNR relay simulates a corresponding relay of an OR. The CNR relay operated, locks and lights CNR lamp. The marker having received locking ground on the CNR lead, grounds the DIS1 lead to operate the DIS1 relay shown later in the test (SFD-K7).

The CNR key operated grounds the CR lead to simulate an OR which is connected to a coin line and has returned the coin. If coin class of service and a code having a route cross-connection which requires coin return by the OR instead of by the trunks, the CM recognizes the CR ground and completes the connection. The SCN key operated grounds the SCN lead to simulate an OR which has attempted to return a coin but could not. The CM recognizes the SCN ground and sets up a connection to a stuck coin trunk instead of to a trunk in the route indicated by the code.

The TP/PMM key normal extends ground to the RP lead to signal the marker that a ring party test is being originated. The TP key operated extends ground to the TP lead to signal the marker that a tip party test is being originated.

The PMM key operated extends ground to the RP and TP leads to signal the marker that there is a party mismatch. This causes the marker to time out and give a trouble record followed by a trouble release except when the marker bypasses the check for mismatch as it does for example on partial dial calls.

The FACD key normal or CL switch set to OR-DP/OR-MF extends ground on the OR lead to give the marker an OR class indication (SFD-K118).

The FACD key operated or CL switch in FAC-DP/FAC-MF extends ground on the FAC lead to give the marker and FAC class indication.

K1-3 MARKER INPUT (INC CLASS)

On INC class of marker test, the MTC simulates an incoming trunk, IR, and IRMC. Through the operation of control key(s) and switch(es), the CM is primed with called number, trunk link location, and other information which it would normally receive from the IR.

K1-3.1 SIGNAL TO OPERATE KEY CONNECTING RELAYS

When the MTC is normal, most of the leads to the MTFC are isolated at open contacts of key connecting relays (MT-). The class-of-test relays operated determine the connecting relays which will be operated to close through the MTFC.

Certain test relays of the CM are operated under control of keys for some tests and not for others. Any of these relays, which are to be operated for a test, must be operated before the marker starts to function. A check lead loops through these relays in the marker and relays, keys, and switches of the MTC to insure that the proper combination of relays has been operated before ground is closed .

K1-3.2 JUNCTOR SEQUENCE (RANDOM OR SELECTED) (SFD-K105)

In order for the CM to start its functions, the MC relay in the MTC must be operated.

K1-3.2.1 Random Junctor Sequence

For a random junctor sequence the JSQ- key or switch will be released or set in the OFF position. A path from the CM through an MT- and TS- (if equipped) connector relays will operate the MC relay in the MTC. The CM may then proceed with its functions.

K1-3.2.2 Particular Junctor Sequence Selected

With the JSQ switch or JSQ- key operated to the desired junctor sequence, the operating of the TS- connecting relays causes the operated JSQ(0-5) relay of the marker to be released and the selected one to be operated. The operated KCH relay through JSQ- key or JSQ switch operates the MT8 relay in the CM. The MT8 operates the MT8A and extends a ground to the MTC to operate the KJSQ relay in the MTC. When the JLE or JLO relay operates in the CM, the MT8 relay releases in turn releasing the MT8A.

The release of these relays extends the ground standing on the MT1 relay through keys or switches (operated or released) in the MTC through KJSQ relay in the MTC to operate the MT8K relay. The MT8K locks to the KCH relay ground and extends ground from CM to operate the MC relay. The CM proceeds with its function.

K1-3.3 REGISTRATION OF TRUNK CLASS INFORMATION IN CM

K1-3.3.1 Registration of Trunk Class Information Using IC Keys or Switches (MD)

The KIC and KIC1 relays operate upon operation of the MC4 relay (SFD-K117). These relays are used to extend ground to keys or switches used on INC class of test.

The operated SPL key signals the CM to handle a special class of call (SFD-K116). This key should be used only with special markers.

The following keys or switches are used to determine the trunk class information.

The IC-OA key or switch simulates a four digit incoming call to be terminated in a single office or in office A or a multioffice marker group.

The IC-OB key or switch simulates a four digit incoming call to be terminated in office B of a multioffice marker group.

The IC-AB key or switch, with THC/PHC key normal, simulates a five digit incoming call and the initial digit indicates the required office.

The IC-FVD key or switch signals the CM to look at the single office digit.

With the RO key and TCBT normal, the KIC1 relay operates the TCA relay in the CM.

K1-3.3.2 Registration of Trunk Class Information Using TRNA, TRNB, CL and ICL Switches (STD)

The MC3 relay in the MTC extends ground to the TRNB switch. The TRNB switch set in the OA position will signal the CM that a four digit incoming call terminates in a single office or in office A of a multioffice marker group. The TRNB switch set in the OB position will signal the CM that a four digit incoming call terminates in office B of a multioffice marker group. The TRNB switch in the FVD position will signal the CM to use its five digit translator and that the initial digit indicates the required office.

The MC21 extends ground to the TRNA, CL, and ICL switches. The TRNA switch extends ground to CM as covered in the previous paragraph. The ICL switch operates the TSC6 relay in CM over the INC lead. The TSC6 relay signals the CM that this is a INC test by operating the INC relay in the CM. The CL switch extends ground to CM on TCA or TCB lead to operate TCA or TCB relay in CM.

K1-3.4 CALLED NUMBER

The MC4 relay operates K relay (SFD-K119). The K relay closes ground from the operated A-L keys or switches, operating corresponding KA-KL relays. The operated KA-KL relays extend ground from the operated A-L keys or switches to the marker CM(SFD-K120-K123).

The K relay also operates the K1 relay (SFD-K119). The K1 is slow operating to allow the slowest KA-KL relay to operate before continuing the function of the circuit. The operated K1 relay provides ground for a KA-KL relay contact chain. The last operated KA-KL relay extends this ground to lead 7 of the next higher lettered digit as an indication to the CM that no further digits are to be expected.

K1-3.5 TRUNK LINK FRAME NUMBER

The KTF relay operates upon operation of the MC4 relay on INC class of test (SFD-K129) to extend grounds from contacts of the FG(0-2) key and FS(0-9) key or switch to signal the TL number to the marker.

K1-3.6 MISCELLANEOUS INPUTS (SFD-K117, K118)

K1-3.6.1 Second Trial (TR2 Key Operated)

With the TR2 key normal, the TRK lead is grounded, causing the CM to function as for a first trial seizure. Operating the TR2 key causes the TR2 lead to be grounded and the marker functions as for a second trial seizure.

K1-3.6.2 Connector Start Transfer (TRS Key Operated)

Operating the TRS key causes the TRS lead to be grounded. The marker recognizes this ground as a connector start transfer signal (simulated IRMC). After setting up the required connection, the CM gives a trouble record having a TRS punch. In service, and when the CM is on light traffic, this record would indicate the IRMS used but because this connector is simulated on a test call, this information is missing on the test record. The REC key should be normal when the TRS key is used.

K1-3.6.3 Line Release Failure (LR Key Operated)

The LR key is operated to simulate a signal from an IR that the IRL failed to release (SFD-K118). The CM takes a trouble record, grounds the BT lead, operating the test circuit BT relay, which lights the BT-OF lamp (SFD-K107). The RS0 and RS9 relays are operated by the CM to simulate setting up reorder on the ringing switch. The OFL lamp is lighted.

K1-3.6.4 Incoming Register Link Double Connection (DCK Key Operated)

The DCK key is operated to simulate a signal from an IR that there is a double connection on the IRL (SFD-K118). When the KINC relay operates, the LR lead is grounded but the DCK lead is not. The marker takes a trouble record and then grounds the BT lead, operating the BT relay, which lights the BT-OF lamp.

The marker does not operate the F relay and does not operate the trunk class relays or RS(0-9) relays.

SECTION K, PART 2

OUTGOING SENDER SELECTION

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K2 OUTGOING SENDER SELECTION (ORIG CLASS)

The ORIG class of test may be made by selecting a route using an Intraoffice (IAO) or Outgoing (OG) code. If an IAO code is used and an Outgoing Sender (OS) is not required, this part of the SFD is not required.

The particular code (ABC) setup on A-C keys or switches directs the CM to operate a route relay (R---) that will select an IAO or OG trunk.

When an OG code is selected, the CM determines outgoing sender group and outgoing trunk information from cross-connects on the route relay. The CM also determines the pulsing information that must be passed to the OS.

When an ORIG test is made, the MTC may be used to instruct the CM to select a particular OS.

K2-1 SELECTING A PARTICULAR OUTGOING SENDER

The CM is directed to select a particular OS under control of the OSS key, SGA/SGB key and OS(0-4) keys or switches. When forcing selection of a particular OS, the CM is also made to override plugged-busy senders. The OSS key makes selection of a particular sender effective. The SGA or SGB key is operated to direct the CM to select subgroup A or B. The OS(0-4) key or switch is operated to direct the CM to select a particular OS in the subgroup.

With the OSS key operated, the KOS relay operates and locks (as shown on SFD-J123). The KOS relay in the MTC, operated, grounds the MT2 lead to the CM to operate the MT2 relay (SFD-J123) after the MTFC has operated the MT relay. The KOS relay opens the operate path of the MC relay (SFD-K105) to require that the MT2 relay in the CM operates to reclose the lead before the MC relay can operate. The KOS partly closes the path to operate the KOSA relay (SFD-K117). Upon operation of the MC relay in the MTC the MC3 relay is operated which closes the path to operate the KOSA.

K2-1.1 IDLE OUTGOING SENDER TEST

When the CM operates one of its OSG(0-11) relays, the corresponding OSG(0-11) relay of the test circuit is operated (SFD-K203). The OSG(0-11) relay operated, removes one of the ground supplies for the make-busy jacks of that sender group (SFD-K206). It also grounds a lead through the SGA or SGB key operated to the SIA or SIB lead to operate the SIA or SIB relay in the marker. The normal operate path of the SIA or SIB

relays opened by the MT2 relay (SFD-K203). The SIA or SIB relay of the marker operated, closes the start lead to the A or B sender subgroup (SFD-K204). After the marker has gained access to the subgroup, it grounds the SSA or the SSB lead, operating the SSA or SSAA or SSB and SSBB relays in the MTC. The SSA and SSAA or SSB and SSBA relays operated, removes the remaining ground supply for the make-busy jacks of the A or B subgroup to which the marker has connected, allowing the marker to select senders which have been plugged busy (SFD-K206).

When the KOS relay in the MTC operated, the ASB relay operated. Upon operation of the SSA and SSAA or the SSB and SSBA relay the ASB relay in the MTC starts to release. The ASB relay is a slow release relay. Upon release, it grounds the ASB lead to the CM which operates the ASB relay in the CM until a sender has been selected and the OSK relay in the CM has operated. The combined release time of the ASB relay in the MTC and the operate time of the ASB relay in the CM exceeds the maximum time required to release the MB relays of any plugged-busy senders and to select a sender and release the OSK relay of the CM.

K2-1.2 OUTGOING SENDER SUBGROUP SELECTION (SFD-K204)

It is necessary to determine if the Outsender Connector (OSC) associated with subgroup A or B is busy. The OSG- relay extends the GBE, group busy even (for even numbered markers) and GBO, group busy odd (for odd numbered markers) leads from the OSC to the CM. The presence of ground on either lead indicates the connector is busy. This ground also operates GBA or GBB relays. The operation of the SIA or SIB relay or the GBA or GBB directs the marker to seize one of two connectors. The OSC is seized when the CM extends battery over the start lead to operate the MP-, marker preference, relay in the OSC preference control circuit. To check that the MP- relay operates, ground is extended through the MP- relay to the completing marker to operate the SKA or SKB, sender connector check subgroup A/B.

K2-1.3 OUTGOING SENDER CONTROL

The MT2 relay in the CM operated, opens the OS(0-4) leads. The operated OS(0-4) key or switch closes through the operate path of the selected OS- relay. The CM then can only select that sender corresponding to the OS(0-4) key or switch.

If the CM does not find idle the sender to which it is directed, the ASB relay of the marker is operated (SFD-K206) to ground the SB lead, (SFD-K606,K607) which is split in the marker by the MT1 relay, operated on test calls and is controlled in the MTC.

When the CM has selected a OS, it grounds the OSK lead, operating the OSK relay (SFD-K203), which releases the SST1 relay or releases the SSA and SSAA or SSB and SSBA relays to restore the plugged-busy condition previously removed from senders in the subgroup selected.

K2-1.4 ESTABLISHING CONNECTION BETWEEN CM AND OS

The CM establishes connection between CM and OS, checks the connection and passes digit and pulsing information to OS (for detailed information on this portion of test see service circuits in SFD-10-01-C2.

The AVK1 relay in the CM is a check that all information has been passed to OS, a connection has been established between the OS and outgoing trunk and a channel has been established between the LL and TL (DCT relay in the CM operated). The DCT relay operation will be covered in SFD-10-01-K6.

SECTION K, PART 3

TRUNK LINK SELECTION AND ORIGINATING REGISTER/
TRUNK SEIZURE

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K3 TRUNK LINK SELECTION AND ORIGINATING REGISTER/TRUNK SEIZURE

When a DTM has been seized and has received input information from the MTC, it proceeds to select a Trunk Link Frame (TL) with idle Originating Registers (OR) or an OR that is made busy if appropriate keys and/or switches have been operated. The DTM then proceeds to connect to the OR.

On ORIG class when a CM has been seized and has received input information from the MTC, it proceeds to select a TL with the correct type of trunk that is idle. The CM can be directed to select a trunk that is made busy if appropriate keys and/or switches have been operated. The correct type of trunk is determined by the selected route.

If idle trunks are not available or if the selected trunk is not part of the operated route, the CM will attempt to route advance.

On INC class the functions of the incoming trunk, ringing switch, and portions of the TL are simulated. Incoming trunk class information normally received from the TL is passed to the CM from the MTC.

K3-1 TRUNK LINK SELECTION AND ORIGINATING REGISTER SEIZURE (DT CLASS)

The DTM can be directed to select a particular TL under control of the FG(0-2) key, FS(0-9) key or switch, and FS/NTFS key and to select a particular register within a trunk block on that frame under control of the TS(0-19) keys or TSU switch and TST1 key and TS/NTTS key.

The TKS relay is operated for selecting a particular OR. In order to direct a DTM to select a particular OR, the DTM must be provided with information which it will translate to operate a route relay which includes the desired OR as part of its route. The DT class of test signals the DTM to set up to an OR. The marker routes to an OR under control of the MF, and MLF keys or switch.

The DTM is directed by the FG(0-2) and FS(0-9) keys or switch to select the TL in which the OR appears. The DTM is directed to select a particular OR within a twenty block by operation of one of the TS(0-19) keys or TSU switch.

K3-1.1 SELECTION OF A PARTICULAR TRUNK LINK FRAME (FS KEY OPERATED)

The FS, FG(0-2), and FS(0-9) keys or switch are operated to restrict the DTM to test for idle registers only on that TL corresponding to the operated FG(0-2) and FS(0-9) keys or switch (SFD-K304).

With the FS key operated, operation of the TKS relay operates the KFS relay which locks (SFD-J107). The MT4 lead is grounded for use with wire spring dial tone markers. When the MTFC has operated the MT relay in the DTM, test relays MT4, 14, 24 are operated in the DTM over the MT4 lead to open the battery normally supplied to windings of the FTC(0-29) relays and to connect the windings to the FTC(0-29) leads to the MTC (SFD-K304).

The operated FS key opens the operate path of the MC relay of the MTC to require that certain test relays of the DTM operate to close the lead before the MC relay can operate to allow the MTC to prime the DTM.

When the DTM connects the FTC- relay windings to the TL FTC- leads for the route selected, those windings are grounded corresponding to TL having idle originating registers in the route. However, only that FTC-relay can operate which has battery supplied to it, which is under control of the FG(0-2) and FS(0-9) keys or switch and the KFS operated and KMT9 relay normal.

K3-1.2 SELECTION OF A PARTICULAR TRUNK LINK FRAME (NTFS KEY OPERATED)

The NTFS key, the FG(0-2) key, and the FS(0-9) key or switch are operated to select a particular TL without first testing for an idle OR on the frame and without testing for manual frame make-busy condition (SFD-K304). This method of particular TL selection is required in order to allow the DTM to connect to a TL on which all registers are plugged busy or busy in service. The DTM must be connected to the TL before it can operate a relay on that frame which allows the DTM to select a plugged-busy OR.

With the NTFS key operated, operation of the TKS relay operates the KMT9 and KFS relays which lock to the TKS relay (SFD-J107).

The KFS and KMT9 relays ground the MT9 lead to operate test relays in the DTM when the MT relay has been operated by the MTFC.

The NTFS key operated opens the operate path of the MC relay of the MTC and requires that the proper test relays of the DTM are operated before the MC relay can operate to allow the MTC to prime the DTM.

When the MTFC operates the MT relay, ground on the WSD lead operates the WSD relay of the MTC to change the manner in which NTFS TL selection is made.

The operated KMT9 relay causes the MT9, 19, and 29 relays to operate in the DTM but prevents operation of the MT4, 14, and 24 relays. The MT9, MT19, and MT29 relays in the DTM transfer the operate paths for the FTC- relays from the FTC- leads that extend to originating registers on the respective TL to the FTC- leads that extend to the MTC where one lead is grounded through an operated FS(0-9) key or switch and the FG(0-2) key to ground on the operated WSD relay (SFD-K304).

K3-1.3 SELECTION OF A PARTICULAR ORIGINATING REGISTER WITHIN A TWENTY BLOCK (TS KEY OPERATED)

The TS key and the TS(0-9) key or TSU switch are operated in order to restrict the DTM to testing for an idle condition, only that OR of a trunk block corresponding to the operated TS(0-9) key or TSU switch.

With the TS key operated, the KTS relay operated when the TKS relay is operated (SFD-J107). The MT1 relay operates on all test calls. In the DTM, the operate path between the TSE1 and TSE2 relays is split and is brought into the MTC where it is reclosed through the KTS relay normal to allow normal OR selection (SFD-K310). The KTS relay operated transfers the TSE1 lead from the TSE2 lead to the MT5 lead. When the DTM grounds the TSE1 lead, the MT5 and MT6 relays, instead of supplying battery to all the windings of the TT(0-4) relays of the DTM, connect the windings to the TT(0-9) leads to the MTC where battery is supplied through the TT ballast lamp, the KTS relay operated, and the operated key or TSU switch with the TST1 key normal to the corresponding TT(0-9) lead. Thus the DTM, although receiving grounds on all BT leads from idle register in the route, can select only that OR in the twenty block corresponding to the operated TS(0-9) key or TSU switch. The OR can be selected only if it is not handling a call and not manually made busy.

The TT0-4 relays are double wound and may be operated if either an even or odd key or switch is operated. This allows the DTM to select either of two originating registers. To prevent this, the MT6 relay in the DTM opens the leads which permit the DTM to prefer odd or even originating registers and extends both ends of these leads to the MTC as Even Trunk Selection (ETS0 and ETS1) and Odd Trunk Selection (OTS0 and OTS1). All even TS(0-9) keys or positions on TSU- switch connect ETS0 and ETS1 leads to permit selection of even originating registers and all odd TS(0-9) keys or positions on TSU- switch connect OST0 and OST1 to permit selection of odd originating registers (SFD-K312).

K3-1.4 SELECTION OF A PARTICULAR ORIGINATING REGISTER WITHIN A TWENTY BLOCK (NTTS KEY OPERATED)

The NTTS key and the TS(0-9) key or TSU switch are operated in order to restrict the DTM to testing for an idle condition, only that OR of a trunk block corresponding to the operated TS(0-9) key or TSU switch and to remove all plugged-busy conditions on the TL to which the DTM connects in order to allow plugged-busy originating registers to be selected.

The MTC and the DTM operate the same with the NTTS key operated as with the TS key operated with the following exceptions:

- (a) Upon operation of the MC6 relay, the NTTS key and the KTS relay operated, the TST lead is grounded (SFD-K312). This lead is closed through the MTFC to the TL to which the DTM is connected and operates the TST relay in the TL. This relay removes the manual make-busy condition from all trunks and registers on that TL.
- (b) When the DTM connects to a TL, the winding of the TST relay of the MTC is connected to a make-contact of the TST relay of the TL to detect when the TST relay is operated. With the NTTS key operated, when the TST relay of the TL operates, it in turn operates the TSK relay to light the TSK lamp as an indication of satisfactory operation of the TST relay. The TSK relay also serves as a cross-detecting relay on tests where the TST relay of a TL is not to be operated. If the TSK lead has a false ground on it, the TSK relay operates, locks, and lights the XTSK lamp from ground on the NTTS key normal or the KTS relay normal. When the HMS1 relay in the marker operates (in part K6), it operates the HMSA relay in the MTC. This opens the TST lead to release the TST relay in the TL which restores the plug-busy condition to trunks and registers on that frame.

K3-2 TRUNK LINK SELECTION AND TRUNK SEIZURE (ORIG CLASS)

The CM can be directed to select a particular TL under control of the FG(0-2) key, FS(0-9) key or switch, and FS/NTFS key, to select a particular trunk within a trunk block under control of the TS(0-19) key or TSU switch and TST1 key and TS/NTTS key, to select a particular allotter group (if the route being set up is allotted) under control of the GPA/GPB key, and to route advance the desired number of times under control of the RA(0-3) key (or RA or RAU switch and RAT1 key).

The ORIG class of test signals the marker to set up to a trunk. The called number keys or switches A(0-9) through L(0-9) should be operated for a code whose route includes the desired trunk. If the route includes allotted groups of trunks, the marker must be directed to the proper allotted group using the GPA/GPB key.

The RA(0-3) keys (RA or RAU switch and RAT1 key) are provided to insure that the marker route advances as required to operate the route relay which includes the desired trunk in its route.

The marker is directed by the FG(0-2) key and the FS(0-9) key or switch to select the TL on which the trunk appears and is directed to select a particular trunk within a twenty block by operation of one of the TS(0-19) keys or TSU switch and TST1 key.

K3-2.1 SELECTION OF A PARTICULAR TRUNK LINK FRAME (FS KEY OPERATED)

The FS key, the FG(0-2) key, and the FS(0-9) key or switch are operated to restrict the CM to test for idle trunks only on that TL corresponding to the operated FG(0-2) key and FS(0-9) key or switch (SFD-K304).

With the FS key operated, operation of the TKS relay operates the KFS relay, which locks (SFD-J107) and grounds the MT3 lead to the CM. When the MTFC has operated, the MT relay in the CM operates and MT4, 14, 24 relays are operated in the marker over the MT3 lead. The battery normally supplied to windings of the FTC(0-19) relays are opened and the windings are connected to the FTC(0-19) leads to the MTC(SFD-K304).

The operated FS key opens the operate path of the MC relay of the MTC to require that certain test relays of the CM operate to close the lead before the MC relay can operate to allow the MTC to prime the CM.

When the CM connects the FTC- relay windings to the TL FTC- leads for the route selected, those windings are grounded, corresponding to TL having idle trunks in the route. However, only that FTC- relay can operate which has battery supplied through the control of the FG(0-2) key, the operated FS(0-9) keys or switch, the KFS relay operated, and the KMT9 relay normal.

K3-2.2 SELECTION OF A PARTICULAR TRUNK LINK FRAME (NTFS KEY OPERATED)

The NTFS key, the FG(0-2) key, and the FS(0-9) key or switch are operated to select a particular TL without first testing for idle trunks on the frame and without testing for manual frame make-busy conditions (SFD-K304). This method of particular TL selection is required in order to allow the

CM to connect to a TL on which all trunks are plugged busy or busy in service. The CM must be connected to the TL before it can operate a relay on that frame which allows the marker to select a plugged-busy trunk.

With the NTFS key operated, operation of the TKS relay operates the KMT9 and KFS relays, lock to the TKS relay (SFD-J107).

The KFS and KMT9 relays ground the MT3 and MT9 leads to operate test relays in the CM when the MT relay has been operated by the MTFC.

The NTFS key operated opens the operate path of the MC relay of the MTC and requires that the proper test relay of the CM are operated before the MC relay can operate to allow the MTC to prime the CM.

The MT9, 19, 29 relays operated in the CM prevent it from making normal TL selection and instead prepares it to select the TL as it would on an incoming call from grounds on the FG(0-2) leads and the TF(0, 1, 2, 4, 7) leads on a 2-out-of-5 basis (SFD-K307).

The KMT9 relay operates the KTF relay (SFD-K129) which closes grounds on the FG(0-2) leads and the TF(0, 1, 2, 4, 7) leads from contacts of the operated FG(0-2) key and FS(0-9) key or switch (SFD-K307) causing the CM to connect to the corresponding TL. The FCK lead from the CM is closed back to the CM on the FTCK lead to operate the marker FTCK relay (SFD-K309, K311), which cannot operate over its normal path because the FTC(0-29) relays of the CM have been prevented from operating.

When the CM grounds the MAK1 lead (SFD-K305), (indicating it has connected to the TL), ground is extended through the MC6 relay operated, the XFT relay normal, the KFT, KMT9, and KFS relays operated, the operated FG(0-2) key and FS(0-9) keys or switch to the FTC(0-29) lead, corresponding to the TL to which the CM was directed. The ground extends through the FTC(0-29) relay winding of the CM, through the operated R(---) or FC(---) relay for the route being set up, to the TL to which the CM is connected. If the CM has been directed to a TL which does not include any trunks for the route, the FTC(0-29) lead may be cross-connected to the XFT lead to operate the XFT relay of the CM. This blocks the CM, causing it to give a trouble record with an XFT indication, followed by a trouble release signal, and also operates the XFT relay of the MTC. The XFT relay operated, lights the XFT lamp and opens the ground to the FTC(0-29) lead.

If the CM has been connected to a TL which does not include trunks for the route, the FTC(0-29) lead will not be connected to the XFT lead and the CM will proceed with trunk selection.

K3-2.3 SELECTION OF A PARTICULAR TRUNK WITHIN A TWENTY BLOCK (TS KEY OPERATED)

The TS key and the TS(0-19) key or TSU switch and TST1 key are operated in order to restrict the CM to testing for an idle condition, only that trunk of a trunk block corresponding to the operated TS(0-19) key or TSU switch and TST1 key.

With the TS key operated, the KTS relay operates when the TKS relay is operated (SFD-J107). The MT1 relay operates on all test calls. In the CM, the operate path between the TSE1 and TSE2 relays is split and is brought into the MTC where it is reclosed through the KTS relay normal to allow normal trunk selection (SFD-K311). When the marker grounds the TSE1 lead, the MT5 and MT6 relays are operated in the marker instead of the TSE2 relay. The MT5 and MT6 relays, instead of supplying battery to all the windings of the TT(0-9) relays of the marker (SFD-K313), connect the windings to the TT(0-19) leads to the (SFD-K313). Battery is supplied by the TS(0-19) key (or TSU switch and TST1 key) to the corresponding TT(0-19) lead. Thus the marker, although receiving grounds on all BT leads from idle trunks in the route, can select only that trunk in the twenty block which corresponds to the operated TS(0-19) keys (or TSU switch and TST1 key). The trunk can be selected only if it is not handling a call.

The TT0-9 relays are double wound and may be operated if either even or odd key or switch is operated (SFD-K313). This allows the CM to select either of two trunks. To prevent this, the MT6 relay in the CM opens the leads which permit the CM to prefer odd or even trunks and extends both ends of these leads to the MTC as ETS0 and ETS1 (even trunk selection) and OTS0 and OTS1. All even TS(0-9) keys or positions on TSU- switch, with TST1 key operated or released, connect ETS0 and ETS1 leads to permit selection of even trunks and all odd TS(0-9) keys or positions on TSU- switch, with TST1 key operated or released, connect OTS0 and OTS1 leads to permit selection of odd trunks (SFD-K313).

K3-2.4 SELECTION OF A PARTICULAR TRUNK WITHIN A TWENTY BLOCK (NTTS KEY OPERATED)

The NTTS key and the TS(0-19) keys (or TSU switch and TST1 key) are operated in order to restrict the CM to testing for an idle condition, only that trunk of a trunk block corresponding to the operated TS(0-19) keys (or TSU switch and TST1 key) and to remove the busy condition from all trunks on the TL to which the CM connects in order to allow plugged-busy trunks to be selected.

An appropriate RA(0-3) key (or RA switch or RAU switch with RAT1 key operated or released) should be operated when the NTTS key is used.

The MTC and the CM operate the same with the NTTS key operated as with the TS key operated, with the following exceptions:

- (a) Upon operation of the MC6 relay, ground is closed from the NTTS key operated through the MC6 and KTS relays operated to the LK lead to the master test frame voltmeter test circuit and to the master test frame test trunk to local test desk as a signal that the manual make-busy condition is to be removed from all trunks on the same TL (SFD-K313).
- (b) Upon operation of the MC6 relay with the NTTS key and the KTS relay operated, the TST lead is grounded. This lead is closed through the MTFC to the TL, to which the CM connected, and operates the TST relay in the TL. This relay removes the manual make-busy condition from all trunks on that TL.
- (c) When the marker connects to a TL, the winding of the TSK relay of the MTC is connected to a make-contact of the TST relay of the TL to detect when the TST relay is operated.

With the NTTS key operated, when the TST relay of the TL operates, it in turn operates the TSK relay to light the TSK lamp as an indication of satisfactory operation of the TST relay. The TST relay of a TL is not to be operated. If the TSK lead has a false ground on it, the TSK relay operates, locks, and lights the XTSK lamp from ground on the NTTS key normal or the KTS relay normal. When the HMS1 relay in the CM operates (in part K6), it operates the HMSA relay in the TL which restores the plug-busy condition to trunks on that frame.

K3-3 TRUNK LINK SEIZURE AND TRUNK SIMULATION (INC CLASS)

On INC class the functions of the incoming trunk, ringing switch and portions of the TL are simulated. Incoming trunk class information normally received from the TL is passed to the CM from the MTC.

K3-3.1 TRUNK LINK FRAME SEIZURE

The CM can be directed to select a particular TL under control of the FG(0-2) key, FS(0-9) key or switch and FS/NTFS key. The operated keys and/or switches extend ground through the MTFC to operate the FG(0-2) relay and TF0,1,2,4,7 on a 2-out-of-5 basis in the CM.

When the TLC1 and TER1 relays operate in the CM (as shown in K1 part), the FG- and TF- relays operated extends battery to the TL preference circuit to operate the MP- or E- (marker preference) relay. The MP- or E- relay operated extends ground back to the CM to ground CK trouble record punch and operate the TFK3 relay to indicate the preference relay has operated. The MP- or E- also extends ground to the TLC to operate connector relays to close paths from CM to the TL.

K3-3.2 SIMULATING INCOMING TRUNK F RELAY

When the marker applies battery to the F lead, the F relay of the MTC operates to simulate the F relay of an incoming trunk (SFD-K316). The F relay operated:

- (a) grounds a lead to the contacts of the ITC key or switch to signal incoming trunk class to the CM,
- (b) operates the FB and FC relay,
- (c) places the winding of the TC and RC relays under control of the CM, and
- (d) operates the KRS relay.

K3-3.3 SIMULATED INCOMING TRUNK CLASS INFORMATION

When the KITC relay operated in the K1 part, it partially closed the path to operate incoming trunk class information in the CM. The F relay, with the ITC-RN(-) key or switch operated, completes this path. The function of the ITC-RN(-) key or switch is the following:

<u>Key</u>	<u>Function</u>
ONN	Not used.
1SE	Extra-theoretical numbers, supervision required.
2SA	All numbers, supervision required.
3NA	All numbers, no supervision required.
4NE	Extra-theoretical numbers, no supervision required.

5ST	Theoretical numbers, supervision required.
6NT	Theoretical numbers, no supervision required.
7RN	Not used.
8SP	Physical numbers, supervision required.
9NP	Physical numbers, no supervision required.

K3-3.4 SIMULATED TRUNK LINK FRAME FB RELAY

The FB relay in the MTC is operated by the F relay (SFD-K316) to simulate an FB relay of the TL. The FB relay operated, grounds the FBK lead to the CM (SFD-K317).

K3-3.5 SIMULATED TRUNK LINK FRAME LC RELAY

When the CM applies battery to the BLC lead, the LC relay in the MTC operates to simulate operation of an LC relay of the TL. The LC relay operated, grounds the LCK lead to the CM (SFD-K317).

K3-3.6 SIMULATING INCOMING TRUNK TC, RC RELAYS AND RSH (RINGING SWITCH) HOLD MAGNET

The TC and RC relays in the MTC simulate corresponding relays of an incoming trunk. The RSH relay in the MTC simulate the ringing switch hold magnet on the ringing switch. The F relay partially closes the path to operate these relays as shown on SFD-K623.

SECTION K, PART 4

NUMBER GROUP CONNECTION
AND TRANSLATION

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K4 NUMBER GROUP CONNECTION AND TRANSLATION

After the CM has received input (SFD-K1) and incoming trunk information (SFD-K3), the CM functions to connect to a number group and translate the called number into line location information as it would for a service call except for the following information.

K4-1 SIMULATING A NO-TEST TRUNK (GENERAL DESCRIPTION)

The S(0-9) key or switch and associated relays, tubes, lamps, and wiring provides a means of testing the marker ability to detect message register potential during the time it is attempting to apply positive potential to the sleeve of the called line and to detect it on one of ten line link sleeves.

Operating the desired S(0-9) key or switch (SFD-K412) causes an operation test to be made of the corresponding PT(0-9) tube and the MPT relay of the CM. If satisfactory, the MPT lamp lights and the operate condition is removed whereupon the CM should apply positive potential to the NTLH lead. This lights the LF lamp. An operation test is then applied to the M(0-9) relay of the CM corresponding to the operated S(0-9) key or switch. If this test is satisfactory, the M lamp in the MTC lights. The M relays operate condition is removed and the marker should then again apply positive potential to the NTLH lead, which is now closed back to apply an operate test to the LF(0-9) relay, corresponding to the operated S(0-9) key or switch. The marker should now complete its functions. At the end of the test, the LK2, DIS1, and MRL lamps should be lighted (SFD-K7).

K4-1.1 SIMULATING A NO-TEST TRUNK (PTL KEY NORMAL)

When the CM operates the F relay in the MTC, the KNT relay is operated through the NT key (SFD-K412). The KNT relay operated, extends its operate ground to the NT lead to signal the CM to handle a no-test call. If the LB key is normal, simulating a line-idle condition, the CM sets up a connection through the regular channels. If the LB key is operated, simulating a line-busy condition, the marker proceeds to set up the connection through the no-test connector. The KNT relay operated provides biasing battery and ground for the LF relay, closes the winding of the NTT and MPT relays to the CM, and shunts the primary winding of the LF relay with a 10-ohm ground.

When the CM grounds the NTT lead, the NTT relay operates. The NTT relay operated, locks on its secondary winding to ground on a break contact of the KR relay and lights the NTT lamp.

The operated MT16 relay in the CM transfer the LL(0-9) and NTLH leads from the line link frame to the MTC. When the CM connects the PT(0-9) tubes to the LL(0-9) leads, the MTC connects positive potential from the voltage divider through a make contact of the NTT relay, break contact of the LF1 through the PTL key normal, through a break contact of the MPT relay, and through contacts of the operated S(0-9) key or switch to the corresponding LL(0-9) lead, to apply an operate test of the corresponding PT(0-9) tube. If the tube operates, the MPT relay of the CM operates and grounds the MPT lead, to operate the MPT relay of the MTC. The MPT relay operated lights the MPT lamp, locks on its secondary winding through a break contact of the LF1 relay to a break contact of the KR relay, operates the MPTA relay which locks and closes the LF relay to the NTLH lead, and removes positive potential from the LL(0-9) lead.

When the positive potential is removed, the PT(0-9) tube is extinguished and the marker MPT relay releases. The CM then proceeds to apply positive potential to the NTLH lead which operates the LF relay of the MTC which in turn operates the LF1 relay. The LF1 relay operated, locks, lights the LF lamp, and releases the MPT relay in the MTC.

The release of the MPT relay closes +130 volts through resistance to the operated S(0-9) key or switch and to the other odd or even lead of the pairs 0-1, 2-3, 4-5, 6-7, 8-9 to apply an operate test to the M- relay associated with those leads.

The LF relay in the MTC and 10-ohm shunting ground remain closed to the NTLH lead through the MPTA relay operated. This shunt prevents firing of the PTL tube from the positive potential applied by the CM. By applying voltage to the two LL(0-9) leads, the voltage applied to the PT(0-9) tubes can be kept low enough to prevent their firing falsely while furnishing adequate current to operate the M relay in the MTC.

Even though the PTL or one of the PT(0-9) tubes should fire falsely because of a surge, the MPT relay in the CM would not receive enough current to operate at this time.

When the M- relay in the CM operates, the CM removes positive potential from the NTLH lead, releasing the LF relay in the MTC, and again closes the PT(0-9) tubes to the LL(0-9) leads. The release of the LF relay operates the M relay in the MTC. The M relay operated closes the winding of the MPT relay in the MTC to the MPT lead.

The CM again connects the PT(0-9) tubes to the LL(0-9) leads and upon finding positive potential on one of the leads, that tube fires and operates the MPT relay in the CM, which grounds the MPT lead and again operates the MPT relay in the MTC. The MPT relay operated removes positive potential from the LL(0-9) lead, locks on its secondary winding, lights the M lamp, and connects a resistance between the NTLH lead and the LL(0-9) lead through the operated S(0-9) key or switch.

When the CM again applies positive potential to the NTLH lead, it feeds through the resistor and an operated S(0-9) key or switch to apply an operate test to an LF(0-9) relay. When an LF(0-9) relay operates, the CM proceeds to set up the no-test connection. The no-test connector hold magnets are operated, but because the no-test trunk is simulated, no select magnets are operated on the no-test connector.

K4-1.2 SIMULATING A NO-TEST TRUNK (PTL KEY OPERATED)

The test proceeds as described in previous paragraphs except that with the PTL key operated, an operate test of the PTL tube is substituted for the operate test of a PT(0-9) tube by transferring the positive potential from the LL(0-9) lead to the NTLH lead.

K4-2 PBX HUNTING CONTROL AND NUMBER GROUP SELECTION

The PBX relay operates on INC class of test if the CM grounds the HF lead. It lights the PBX lamp and locks to ground on a break contact of the KR relay (SFD-K409).

K4-2.1 PBX CONTAINED IN ONE TENS BLOCK OR ARRANGED FOR BLOCK HUNTING

The PBXH/EBH key should only be used on INC class of test with a PBX number (SFD-K411). The PBXH key and one of the S(0-9) key or switch are operated to direct the CM to select only that PBX line having a position in a tens block corresponding to the operated S(0-9) key or switch.

The PBXH key operated, operates the MT10 relay after the MTFC has operated the MT relay in the CM. The PBXH key opens the operate path of the MC relay in order to check the operation of the MT10 relay in the CM (SFD-K105). The lead is reclosed by the operation of the MT10 relay in the CM. When the MC3 relay in the MTC operates, the KPBX relay operates through a break contact of the Z relay (SFD-K411) to close ground from the operated S(0-9) key or switch to the winding of the corresponding SL(0-9) relay in the CM from which grounds were removed by operation of the MT10 relay. The CM then can find idle only that PBX line corresponding to the operated S(0-9) key or switch. When the marker grounds the SLCK

lead, the W relay operates. When the ground is removed from the SLCK lead, the Z relay operates to release to KPBX relay. This prevents finding an idle line in a subsequent tens block if the line corresponding to the S(0-9) key or switch operated is busy in the tens block associated with the number set up on the code and digit keys and switches. The marker progresses to end-of-group and sets up line busy. A line-busy condition can be simulated by having all S(0-9) keys or switches normal.

K4-2.1.1 End-of-Block Hunting

The EBH key is operated to force the marker to find no PBX lines idle in the tens block associated with the number setup, but to allow it to find idle that line in a subsequent tens block corresponding to the operated S(0-9) key or switch. The circuit functions the same as with the PBXH key except that the KPBX relay is prevented from operating until the SLCK lead has been grounded to operate the W relay and the ground removed to operate the Z relay in order to insure that the CM has advanced from the first tens block.

The CM block-hunts until it finds an idle number corresponding to the S(0-9) key or switch or until it reaches end-of-group and sets up line busy. A line-busy condition is indicated by a BY lamp together with MRL and DIS1, but no LK2 lamp.

K4-2.2 PBX NUMBER ARRANGED FOR BLOCK SELECTION

When the PBXH key and S(0-9) key or switch are used with a nonallotted PBX number arranged for block selection, the operation is as described above if the number corresponding to the operated S(0-9) key or switch is idle.

If that number is busy in service, a trouble record card showing SLCK but no A or AK punch will usually result. However, a line-busy condition will be set up if the number used is in the first tens block and all numbers in subsequent tens blocks are busy, or if the number used is in a tens block subsequent to the first and all numbers associated with the same PBX in that tens block are busy. These conditions can be simulated by blocking relays in the NG.

The EBH key and S(0-9) keys or switch are used somewhat differently for PBX numbers arranged for block selection since the CM progresses directly from the first tens block to the first subsequent tens block having idle numbers, but cannot progress from a tens block other than the first to any other tens block.

The number setup should always be in the first tens block. The MTC then will simulate all lines busy in the first tens block and cause the CM to progress to the first subsequent tens block having idle numbers. During light traffic this will usually be the second tens block. Calls to other tens blocks can be forced by blocking relays in the NG.

If the CM progresses to a tens block having idle numbers but with the number busy corresponding to the operated S(0-9) key or switch, a trouble record showing SLCK but no A or AK will result. If all tens blocks subsequent to the first are busy, the CM will set up a line-busy condition.

K4-2.3 NUMBER GROUP SELECTION CONTROL FOR ALLOTTED PBX GROUPS

The NG(A-H) keys, NGT key and NGT relay in the MTC are provided in offices having a number group allotter circuit for large PBX groups (SFD-K414).

When the NGT key is normal, the number group allotter is permitted to function on marker test calls in the same manner that it does on service calls to a large PBX group. The allotter selects, in preference order, the first NG which does not indicate that all numbers associated with the PBX being called are busy.

When the NGT key is operated, the NGT relay is operated on marker tests following operation of the MKT2 relay. This grounds the TNCA lead to the CM which extends the ground to operate test relays in the PBX allotter. These relays transfer the PBX busy test leads from the number groups to the MTC on the NGT(A-H) leads through the NGT relay to corresponding NG(A-H) keys.

Any combination of number groups may be made to appear to have all PBX lines busy by operating the proper NG(A-H) keys to close battery to the associated leads to the CM. In order to select a particular number group, all NG(A-H) keys but the one corresponding to the particular number group are pulled out.

It should be noted that the association between keys and number groups varies between PBX groups in accordance with marker cross-connections.

Having selected a particular NG, hunting within the NG can be controlled as described above. The allotter will be called in only when numbers in the same tens block as the directory number of the allotted PBX are called. Calling other numbers in the PBX group causes the CM to connect directly to the NG in which that number appears, just as it would for a nonallotted PBX.

All number groups may be made to appear busy by operating all NG(A-H) keys. This should force a line-busy condition to be set up.

Various recycles may be forced by using LB, LBL, or PBXH (with no S(0-9) key or switch) as previously described to create line-busy conditions.

SECTION K, PART 5

LINE LINK SEIZURE

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K5 LINE LINK SEIZURE

After the DTM has seized a TL, it bids for access to the simulated Line Link (LL) via the associated Line Link Connector (LLC). The leads necessary for vertical file identification are closed through at this time. When class-of-service keys or switches are normal, the DTM functions as on a service call to obtain class of service. The class-of-service may be selected as explained in K5-1.2.

After the CM has seized, a TL (and NG on INC class), it bids for access to the LL via the associated LLC.

K5-1 LINE LINK SEIZURE (DT CLASS)

The FTT- and FUT- relays operate from FT- and FU- relays shown in the K1 part. The TFK1 relay operates in the DTM as shown in K1 part to check that the DTM has connected to a TL. The CK punch is an indication that the TFK1 relay has operated.

The DTM proceeds to connect to the selected LL through the LLC as it would on a service call. When the DTM has connected to the LL, the LLC MA1- relay provides ground on the LFK lead to operate the LFK relay in the DTM.

K5-1.1 VERTICAL FILE INPUT TO DTM

When the DTM has identified the LL and connected to it through the LLC, it proceeds to operate the proper VGB0-11 and HGA,B(0-9) relays in the normal manner (SFD-K513). When the DTM recognizes that a line link HGA(0-9) relay and HGB(0-9) relays have operated, it grounds the HGK lead to operate the KV relay in the MTC. The KV relay simulates that part of a line link LG relay which closes through the VFT(0-4) leads (SFD-K512). The MT11 relay in the DTM will have operated to open the VFT(0-4) leads from the LL to prevent interference from any service calls attempting to originate from the same line group as that being simulated through the TVFT(0-4) leads from the VF(0-4) key or switch to the MTFC for vertical file identification to the simulated calling line.

K5-1.2 CONTROL OF CLASS OF SERVICE

Because offices may be equipped with any of several class of service and rate treatment arrangements, there are necessarily a number of optional arrangements provided in the MTC for controlling class of service and rate treatment. On a DT class of test when the keys or switches for selecting class of service and rate treatment are in normal or off position, the DTM functions as on a service call to obtain the class of

service (and rate treatment if provided) from cross-connections in the LL (SFD-K516,517). When keys or switches are operated to select class of service or rate treatment,* this prevents the DTM from obtaining class of service (and rate treatment if provided) from cross-connections in the LL.

The ground from the DTM which is normally steered through LL cross-connections is instead steered through class-of-service and rate treatment keys or switches of the MTC. Use of these keys or switches to control class of service is intended for use on OR class of test, so that any desired class of service may be set in the DTM for subsequent transfer to the OR.

K5-1.2.1 30 or 60 Classes of Service (SFD-K516)

On test calls, the MT11 relay in the DTM is operated. This opens the normal path through which the DTM supplies ground over a V- lead to the LL to determine class of service from cross-connections in the LL.

When the CST- keys or CST switch are in the off position, the KCS0, 1, and 2 relays are normal and bridge the MT11 break contact in the DTM to permit normal determination of class of service from cross-connections in the LL.

When a CST- key or the CST switch is operated to 0, 1, or 2, the KCS0, 1, or 2 relay, respectively, is operated. When the FTK1 relay operates, ground via the CSG2 lead is steered through an operated KCS- relay contact and through an operated CSU- key or the CSU switch in position 0-9 and again through contacts of an operated KCS- relay to one of the CS0-29 leads corresponding to the keys or key and switch operated.

K5-1.2.2 60 Classes of Service (SFD-K516)

When there are 60 classes of service, in addition to the control described above, the MT1 relay which is operated on marker test calls connects the CGA and CGB relay windings in the DTM from the CGA and CGB leads to the CGA1 and CGB1 leads to the MTC.

The CGB key normal connects the CGA relay to both the CGA and the CGB leads. The CGB key operated connects the CGB relay of the DTM to both the CGA and the CGB leads. Thus, the CGB key position determines whether the CGA or CGB relay of the DTM operates in series with the VGB- relay of the LL regardless of whether the particular VGB- relay VC-terminal is cross-connected to the CA or the CB terminal.

No provision is made for verifying on DT class of test that the cross-connections between VC- and CA or CB terminals are correct.

* In some of the older MTCs which have not been updated, class-of-service and rate treatment keys are not effective on DT class of test.

K5-1.2.3 100 Classes of Service (SFD-K515)

On test calls, the MT11 relay in the DTM is operated. This opens the normal path over which the DTM supplies ground over a V- lead to the LL to determine class of service from cross-connections in the LL. When the CST- keys or CST switch, the CSU- keys or CSU switch, and the CRU- keys or CRU switch are in the normal or off position, the KCS0, 1, and 2 relays are normal. This bridges the MT11 contacts in the DTM to permit normal determination of class of service and rate treatment from cross-connections in the LL.

To control the setting of class of service and rate treatment in the DTM, the CST keys or CST switch, CSU- keys or CSU switch and, if provided, the CRU- keys or CRU switch should be set as desired. This operates the KCS0, 1, and 2 relays to extend the CSG2 lead ground to 1-out-of-10 of the CS0-9, CS10-19, and CS20-29 leads to operate a CST-, CSU-, and CSR- relay, respectively, in the DTM.

K5-2 LINE LINK SEIZURE (ORIG CLASS)

On an ORIG class of test, the CM does not use the Forward Linkage (FLG) but does use the Call Back Linkage (SCB). The CM starts the SCB as soon as the call is indicated as a Subscriber Outgoing Call (SOG). From the selected route, the CM obtains a Sender Off Normal (SON) or No Sender Outgoing (NSO) indication which operates the SOG1,2 relays (shown in K2 part). The SOG1 relay operates the CB, in turn, operating the CB1-CB6 relays (SFD-K505). The CM receives calling line identification from the MTC which is registered on the FT-, FU-, VG-, HG-, and VF-relays and produces the FT'-, FU'-, VG'-, HG'-, and VF'- prime punches (SFD-K1 part). This information determines the calling line through the operated CB, CB1-CB6 relays (SFD-K506-K508). This is further checked in the CM by checking the proper number of relays operated. If this information is correct the RK1, RK2 and RK3 relays operate (SFD-K505). The RK2 and RK3 progress punches are an indication of the line link location check. The calling line location is registered on the FTT-, FUT-, VGT-, HGT-, and VFT- relays (SFD-K506-K508). When the FTT- and FUT- relays operate, the LFS battery is extended from the CM to the ST-leads through the operated LLC2, TFK2, and SOG1 relays to the LLC preference control circuit (SFD-K510). The resistance battery on the ST-leads operates the MP- relay in the preference control circuit, in turn operating connector relays in the LLC. The LFK relay and associated punch (SFD-K513) is an indication that all LLC relays have properly operated.

On ORIG class of test, the KCS0, KCS1, and KCS2 relays are normal. The KCS3 relay, with the CST- and CSU- keys or switches operated, operates the CT2/5 and CUA2/5 relays in the CM (in the K1 part).

When the FTK2, CNA/AOA/MRA, RK3, DTK, FTT-, and FUT- relays operate, the CM progresses as on a service call to establish a channel.

K5-3 LINE LINK SEIZURE (INC CLASS)

On INC class of test, the seizure of the LL is made after the TL and NG have been selected. If trouble is encountered in the progress of the test, at this point, the CK punch will be an indication that the proper TL selection is made. The NGK punch indicates the marker has seized the NG and operated its marker cut-in (MCA) relay (SFD-K4 part). The LFS battery from the CM is applied to the LL-ST lead through the operated LLC2, PTK, RCL, FLG1, FUT-, and FTT- relays in the CM to the ST- lead of the relays in the CM to the ST- lead of the preference control circuit operating the MP- relay and associated LLC multicontact relays (SFD-K-510,K-511). The LFK punch is an indication that all LLC relays have properly operated (SFD-K515).

Although class of service is not required by the CM for controlling the INC call, the class of service is required to control dual voltage operation to operate the line hold magnets. Dual voltage is the application of 178 volts to the hold magnets.

Dual voltage operation of line hold magnets equipped for message register service may cause false operation of the message register. Accordingly the marker must operate all line hold magnets used with lines that are equipped with message registers, using only 48 volts.

SECTION K, PART 6
NETWORK CONNECTION

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K6 NETWORK CONNECTION

The network connection brings together information from K1-K5 parts to complete a connection from the MTC to the OR on DT class, to a trunk on ORIG class and to a simulated trunk on INC class.

K6-1 NETWORK CONNECTION (DT CLASS)

When the DTM has identified the calling line location and has selected an OR, it proceeds to establish a connection through the switching network from the simulated line to the OR. It also transmits line location and other information to the OR.

K6-1.1 LINE IDLE: LINE BUSY/FALSE GROUND ON LINE SLEEVE

With the LB key normal, the MTC simulates a condition of having the line sleeve free of false ground.

With the LB key operated, a condition of false ground on the line sleeve is simulated. This results in a trouble record, indicating the LXP relay in the DTM failed to operate.

K6-1.1.1 Line Idle (LB Key Normal)

With the LB key normal (SFD-K614), the LHMT lead is connected to either the LHM or the NTH1 relays under control of the NTC key (SFD-K614). When the DTM makes a line busy test it will not find ground on the LHMT lead and will proceed to set up the connection to the line except the operation of a line hold magnet will be simulated or the no-test connection will be used.

K6-1.1.2 Line Busy, False Ground on Line Sleeve (LB Key Operated)

When the LB key is operated, the LHMT lead is grounded by an operated KV relay (SFD-K614). The DTM operates the KV relay over the HGK lead (SFD-K513) at approximately the same time that the LHMT lead would have been closed to the sleeve of a line if the DTM had been handling a service call. The DTM will find ground on the LHMT lead when it attempts to operate the line hold magnet and will block (SFD-K614, K617). This simulates a trouble condition which would be encountered in service if the originating line linkage were not released after the DTM has grounded the RL lead to an OR.

K6-1.2 SELECTION OF A PARTICULAR CHANNEL, JUNCTOR SEQUENCE POSITION, OR JUNCTOR STEP POSITION

The DTM can be directed to select a particular channel under control of the CH(0-9) keys or switch, to select a particular junctor sequence position under control of the JSQ(0-5) keys or switch, and to select a particular junctor step position under control of the STP1/STP2 key.

The KCH relay is operated by the MKT1 relay which makes the features for controlling channel and junctor group selection effective.

K6-1.2.1 Channel Selection

With one of the CH(0-9) key or switch operated (SFD-K608), and the KCH relay operated, the MT7 relay in the DTM operates after the MTFC has been connected. The MT7 relay opens the operating grounds for the TCH(0-9) relays in the DTM. The TCH(0-9) leads are brought into the MTC to contacts of the CH(0-9) key or switch. Ground is extended through the KCH relay, the STP1/STP2 key, and the STP relay for operating the TCH(0-9) relay corresponding to the operated CH(0-9) key or switch. The ground supplied on the TCH(0-9) lead is controlled in the DTM by the pattern relays so that a TCH(0-9) relay cannot be operated in the DTM unless the channel is part of the junctor group with which the DTM is working. With the CH(0-9) keys normal or the CH switch in the OFF position, the MT7 relay in the DTM is not operated and channel selection is not restricted except to advance junctor step position.

K6-1.2.2 Junctor Sequence Position Control

The operation of the JSQ(0-5) or switch and associated apparatus is covered in SCD-K1-1.2

K6-1.2.3 Junctor Step Position Control

The STP1/STP2 key is used to allow the DTM to find an idle channel in junctor step position 1 or 2 respectfully.

If no CH(0-9) key or switch is operated the DTM may select any channel within the junctor step position selected above. Operation of a CH(0-9) key or switch restricts the DTM to the selection of only that channel within the junctor step position.

With the STP1 key and the KCH relay operated, the MT7 relay in the DTM is operated after the MTFC has been connected (SFD-K608). When the STP1 relay in the DTM operates, the STP relay in the MTC is operated over the STP1 lead. This releases the MT7 relay of the DTM if no CH(0-9) key or switch is operated and allows the DTM to make channel selection in a normal manner in junctor step position 1. If a CH(0-9) key or

switch is operated, the MT7 relay remains operated in the DTM. The STP relay operated closes the ground which was opened by the operates STP1 key to the TCH(0-9) leads through the CH(0-9) key or switch allowing the DTM to select only that channel corresponding to the operated CH(0-9) key or switch position. If the DTM does not find an idle channel in junctor step position 1 it advances to step 2, releases the STP1 relay and operates the STP2 in the DTM (SFD-K604). This releases the STP relay in the MTC. The STP relay released, opens the ground to the TCH(0-9) leads through the CH(0-9) keys or switch and extends the STP2 lead to the TCHK lead to operate the TCHK relay in the DTM (SFD-K604). With no TCH(0-9) relay operated, the DTM is prevented from selecting any channel in junctor step position 2.

With the STP2 key operated the MT7 relay is operated and the ground to the TCH(0-9) leads removed during junctor step position 1. During step 2 the STP relay in the MTC operates and the MT7 relay in the DTM is released if the CH(0-9) keys or switch are normal to allow the DTM to make normal unrestricted channel selection. If one of the CH(0-9) keys or switch is operated, the MT7 relay in the DTM remains operated. The STP relay operated, supplies ground to the TCH(0-9) lead through the operated CH(0-9) key or switch to restrict the DTM to selection of a channel corresponding to the operated CH(0-9) key or switch. Thus the marker is prevented from finding an idle channel in step 1 but allowed to find one in step 2.

With the STP1 and STP2 keys normal, the DTM makes channel selection in step 1 or 2 in the normal manner except as restricted by the CH(0-9) keys or switch.

K6-1.2.4 Junctor Groups of Less Than Ten Junctors

It should be noted that in offices having junctor groups of less than ten junctors, combinations of junctor sequence position, junctor step position, and channels which do not exist can be set up on the keys. Also in such offices, if a CH(0-9) key or switch is operated but the JSQ(0-5) key or switch or the STP1/STP2 keys are normal, the DTM may progress on successive calls through combinations which do not have junctors corresponding to the operated CH(0-9) key or switch. In either case the DTM will block and take a trouble record.

K6-1.3 TEST OF DIAL TONE SERVICE OBSERVING FEATURE (OBS KEY OPERATED)

When the OBS key is operated (SFD-K624) on a dial tone class of test with the NTC key normal, the test proceeds to the operation of the LHM relay or with the NTC key operated, to the operation of the NTH relay, either of which simulates closure of the line hold magnet. This closes a voltage divider network to the primary winding of the CK2 relay to operate the OBS1 relay in the DTM. The direction of current flow during the operation of the OBS1 relay of the marker is such that the polarized

CK2 relay does not operate. However, when the OBS1 relay has operated and closed its locking circuit, the direction of current through the CK2 relay reverses to operate the CK2 relay which locks in series with the winding of the CK1 relay which also operates. The CK1 and CK2 relays remain operated at the end of the test with the CK lamp lighted.

K6-1.4 CROSSED-LINE HOLD MAGNET

The marker crossed-line hold magnet detecting feature is effective only on dial tone calls handled on a light traffic basis.

With the NTC and XLH key normal (SFD-K614), the LHM relay in the MTC in series with 300-ohms simulates a single line hold magnet winding. Operating the XLH key connects a 3000-ohm resistance around the winding of the LHM relay and the 300-ohm resistance to simulate a cross between hold magnet windings.

The nonoperate test with XLH key normal and the operate test with XLH key operated are not intended to be marginal test of the cross-detecting relay but rather are operation tests of the marker feature.

With the XLH key operated on a light traffic DT test call the DTM should block and take a trouble record showing an XLH punch.

With the XLH key operated on a heavy traffic DT test call or with the XLH key normal on either light or heavy traffic DT test call, the DTM should set up a connection to the originating register.

K6-1.5 TEST OF FCG AND FCGA RELAYS (FCG KEY OPERATED)

When the marker HMS1 relay operates, the HMS1 relay of the MTC is also operated (SFD-K613). The operated MC7 relay extends the TTT and TRT leads from the DTM to the MTC. With the FCG key operated, it imposes an operate test on the FCG relay of the DTM by simulating a cross between the tip and ring of the switches.

K6-1.6 FORCING LIGHT OR HEAVY TRAFFIC TESTS

The DTM times for an interval at the end of each call. If another call is started within this interval, the DTM handles that call on a heavy traffic basis. If another call is not started until after the interval, the call is handled on a light traffic basis.

The DTM can be forced to handle test calls on a heavy traffic basis by operating the HTR key which operates the HTR relay in the DTM.

To force the DTM to handle test calls on light traffic basis only, the marker must be made busy to eliminate service calls. The test calls then are initiated at great enough intervals to allow the DTM to handle them on a light traffic basis.

K6-1.7 CONTROL OF LINE HOLD MAGNET OPERATE PATH

The operation of a line hold magnet is simulated or, when the NTC key is operated, the no-test connector is used instead.

K6-1.7.1 Simulating Operation of Line Hold Magnet

The MT11 relay of the DTM is operated on all test calls to split the line hold magnet lead LHM from the LHMT lead (SFD-K616). The LHM and LHMT leads are brought into the MTC on test calls to be controlled by that circuit (SFD-K614). With the NTC key normal DTM marker grounds lead LHMT to operate the LHM relay which operates the LHMA relay.

The operation of the LHM and LHMA relays simulates the operation of a line hold magnet by extending the LHMT lead back to the DTM on the LLJ lead (SFD-K614, K616) and by closing the TTT and TRT leads to the continuity and ground test portion of the MTC (SFD-K620).

K6-1.7.2 Using No-Test Connector

With the NTC key operated, the NTC and NTC1 relays operate upon operation of the MKT2 relay (SFD-K614). The operation of the NTC and NTC1 relays prepare the MTC for operation with the no-test connector to close the SPC lead to the MTFC over which the F1 relay will be operated when the no-test connector is available to the MTC, and opens the MC relay operate path to insure that the F1 relay has operated before the key connecting relays operate to prime the marker (SFD-K104). The operated NTC and NTC1 relays also transfer the operate path of the LHM relay to the NTH relay (SFD-K614), opens the tip, ring, and sleeve connections to the originating test line and transfers them to the test frame trunk appearance on the no-test connector (SFD-K614, K620), and connects battery to the EXT lead to extend DTM timing because the normal work timer interval of the DTM may be exceeded.

When the TS relay has been operated by the MTFC (SFD-J1 part) indicating that the selected DTM is available for test, the no-test connector start battery is closed from a make contact of the TS relay through the NTC relay operated and the NTB relay normal over the SP lead to the MTFC to operate the SP2 relay (SFD-K614). When the SP2 relay has operated, ground on the SPC lead from the MTFC, through the NTC relay operated, operates the F1 relay. The operated F1 relay operates a select magnet in the no-test connector corresponding to the level of the test frame trunk appearance on each of the no-test connector switches (SFD-K614, K615), closes the operate path to the MC relay which was opened by the operated NTC relay, (SFD-K104), and closes the winding of the NTB relay to the NTH lead of the MTFC.

When the DTM has connected to a LL (SFD-K5 part), the winding of the hold magnet in the no-test connector associated with the horizontal group to which the marker is directing its connection is closed through the LL, the DTM, and MTFC, via the NTH lead to the MTC. The NTB relay is connected to the NTH lead and operates when there is ground on the NTH lead indicating that the no-test connector is busy on the LL to which the connection is set up.

When the NTB relay operates, it opens the SP lead to free the no-test connector preference circuit, lights the NTB lamp, bridges the operate path of the MC relay around the make contacts of the F1 relay to prevent releasing the MC relay when the F1 relay is released (SFD-K104), and releases the F1 relay, which releases the no-test connector select magnet.

When the no-test connector is busy, the DTM blocks because the operation of the line hold magnet cannot be simulated. After a timing interval the marker gives a trouble record followed by a trouble release.

When the DTM grounds the LHMT lead, the NTH relay operates. The NTH relay operated, if the NTB relay has not operated, closes ground to the NTH lead through the DTM and LL to operate the hold magnet of the no-test connector, which in turn operates the no-test hold magnet on the LL, extends the same ground to the H lead to the MTC trunk appearance on the no-test connector to lock the no-test connector hold magnet, and extends the LHMT lead to the S lead and closes the T and R leads to the MTC trunk appearance on the no-test connector.

K6-1.8 CONTINUITY TESTS

Continuity test conditions are imposed on the DTM from the time the DTM operates either the LHM and LHMA relays or the NTH relay of the MTC until the CON relay is operated in the DTM. The operated CON relay indicates that the DTM has completed continuity test.

K6-1.8.1 Loop Continuity Test (CON Key Operated)

The CON key operated (SFD-K620) connects a resistance bridge to the TTT and TRT leads through the CON relay normal and the MC7 relay operated to make a loop continuity test. When the NTC key is operated, a continuity test is made at the tip and ring leads of the service linkage which the DTM set up.

K6-1.8.2 Tip or Ring Continuity Tests (RV Key Operated or Released)

With the CON key normal (SFD-K620), the continuity test condition is applied to the ring when the RV key is normal, to the tip when the RV key is operated.

The RV key should be operated or released to apply the continuity test condition to the side of the line which the DTM is expected to test.

The DTM applies its continuity test to the tip or ring under various conditions. When the OR has recognized the call to be from a tip party (as simulated by the TP key operated) the test is applied to the tip only. Otherwise the ring lead is tested and when the continuity test is not satisfied, then the tip lead is tested.

K6-1.8.3 Polarity of DC Component of Continuity Test (TC Key)

The TC key (SFD-K620) is used for applying negative or positive polarity to the dc component of the current flow test of the marker continuity test feature. When the TC key is normal, a negative component is applied. When the TC key is operated, a positive component is applied. For a complete test, a call with the TC key normal and another call with the TC key operated should be made.

K6-2 NETWORK CONNECTION (ORIG CLASS)

On ORIG class, when the CM has received sufficient information, it establishes a connection between the MTC and trunk.

K6-2.1 LINE IDLE: LINE BUSY/FALSE GROUND ON LINE SLEEVE

With the LB/LBL key normal, the MTC simulates a condition of having the line sleeve free of false ground.

With the LB key operated, a condition of false ground on the line sleeve is simulated. This results in a trouble record, indicating the LXP relay in the CM failed to operate.

K6-2.1.1 Line Idle (LB and LBL Keys Normal)

On ORIG class of test, with the LB and LBL keys normal (SFD-K614), the LHMT lead is connected to either the LHM or the NTH relays under control of the NTC key. If the CM makes a line-busy test it will not find ground on the LHMT lead and will proceed to set up the connection to the line. The operation of a line hold magnet will be simulated or the no-test connector will be used.

K6-2.1.2 Line Busy/False Ground on Line Sleeve (LB Key Operated)

On ORIG class of test when the LB key is operated, the LHMT lead is connected to a make contact of the HGK relay. The winding of the HGK relay is connected through the LB key operated (SFD-K515), the ORIG

relay operated and the MC4 relay operated over the HGK lead to the CM. The CM operates the HGK relay which grounds the LHMT lead at approximately the same time that the LHMT lead would have been closed to the sleeve of a line if the CM had been handling a service call.

If the test call is such that the CM makes a line-busy test, the ground on the LHMT lead appears to be a line-busy condition.

If the test call is such that the CM does not make a line-busy test, the CM will find ground on the LHMT lead when it attempts to operate the line hold magnet and will block. This simulates a trouble condition which would be encountered in service if the originating line linkage were not released after the CM had grounded the RL lead to an OR.

K6-2.1.3 Line Busy at Line Link Frame (LBL Key Operated)

The LBL key should be operated only on an ORIG class of test with an intraoffice code to give first a line-busy condition and then after recycle, a line-idle condition at line link frame.

The CM makes line idle tests of the PBX numbers through the NG and if it finds an idle number connects to the LL. When the CM checks that it has operated an HG relay in the LL it operates the HGK relay of the MTC (SFD-K513). This grounds the LHMT lead at the approximate time that the CM would be connected to the line sleeve if a service call were being handled. The CM finding a line-busy condition after it had received a line-idle condition via the NG, recycles to test through the NG again. If the CM again finds an idle line, it again connects to the NG and again operates the HGK relay.

When the HGK relay operated the first time it operated the PU relay which locked to the MC7 relay operated (SFD-K614). When the CM disconnected from the LL, ground was removed from the HGK lead to release the HGK relay, which removed the shunting ground from the PUL relay to allow it to operate in series with the PU relay. The PUL relay operated, disconnected the LHMT lead from the make contact of the HGT relay, and connected it to either the LHM or the NTH relay, depending on whether or not the NTC key had been operated.

When the CM makes busy test, it does not find ground on the LHMT lead and proceeds to set up the connection to the line, except that, the operation of the line hold magnet is simulated or the no-test connector is used.

K6-2.2 SELECTION OF A PARTICULAR CHANNEL, JUNCTOR SEQUENCE POSITION, AND JUNCTOR STEP POSITION

The CM can be directed to select a particular channel under control of the CH(0-9) key or switch, to select a particular junctor sequence position under control of the JSQ(0-5) key or switch and to select a particular junctor step position under control of the STP1/STP2 key. The KCH relay is operated by the MKT1 relay operated (SFD-J107), which makes the features for controlling channel and junctor group selection effective.

K6-2.2.1 Channel Selection

With one of the CH(0-9) key or switch operated (SFD-K608), and the KCH relay operated, the MT7 relay in the CM operates after the MTFC is connected. The MT7 relay opens the operating grounds for the TCH(0-9) relays in the CM. The TCH(0-9) leads are brought into the MTC to contacts of the CH(0-9) key or switch. Ground is supplied under control of the KCH relay, the STP1/STP2 key, and the STP relay for operating the TCH(0-9) relay corresponding to the operated CH(0-9) key or switch. The ground supplied on the TCH(0-9) lead is controlled in the CM by the pattern relays, so that a TCH(0-9) relay cannot be operated in the CM unless that channel is part of the junctor group with which the CM is working. With the CH(0-9) keys normal (or CH switch in the OFF position) the MT7 relay of the CM is not operated and channel selection is not restricted except to advance junctor step position.

K6-2.2.2 Junctor Sequence Position Control

The operation of the JSQ(0-5) key or switch and associated apparatus is covered in SCD-K1-2.2.

K6-2.2.3 Junctor Step Position Control

The STP1/STP2 key is used to allow the CM to find an idle channel in junctor step position 1 or 2 respectfully (SFD-K608).

If no CH(0-9) key or switch is operated, the CM may select any channel within the junctor step position selected above. Operation of a CH(0-9) key or switch restricts the CM to selection of only that channel within the junctor step position.

With the STP1 key operated, and the KCH relay operated, the MT7 relay in the CM is operated after the MTFC is connected. When the STP1 relay of the CM operates, the STP relay of the MTC is operated over the STP1 lead. This releases the MT7 relay of the CM, if no CH(0-9) key or switch is operated, and allows the CM to make channel selection in a normal manner in junctor step position 1. If a CH(0-9) key or switch is operated, the MT7 relay remains operated in the CM. The STP relay operated,

closes the ground, which was opened by the operated STP1 key, to the TCH(0-9) leads through the CH(0-9) key or switch, allowing the CM to select only that channel corresponding to the operated CH(0-9) key or switch. If the CM does not find an idle channel in junctor step position 1, it advances to step 2, releasing the STP1 relay and operating the STP2 of the CM. This releases the STP relay of the MTC. The STP relay released, reoperates the MT7 relay of the CM, opens the ground to the TCH(0-9) leads through the CH(0-9) keys, or switch and extends the STP2 lead to the TCHK lead to operate the TCHK relay in the CM (SFD-K605). With no TCH(0-9) relays operated, the CM is prevented from selecting any channel in junctor step position 2.

With the STP2 key operated the MT7 relay is operated and the ground to the TCH(0-9) leads removed during junctor step position 1. During step 2, the STP relay in the MTC operates and the MT7 relay in the CM is released, if the CH(0-9) keys are normal (or the CH switch is in the OFF position) to allow the CM to make normal, unrestricted channel selection. If one of the CH(0-9) keys or switch is operated, the MT7 relay in the CM remains operated. The STP relay operated, supplies ground to the TCH(0-9) lead through the operated CH(0-9) key or switch to restrict the CM to select a channel corresponding to the operated CH(0-9) key or switch. Thus the CM is prevented from finding an idle channel in step 1, but allowed to find one in step 2.

With the STP1 and STP2 keys normal, the CM makes channel selection in step 1 or 2 in normal manner, except as restricted by the CH(0-9) keys or switch.

K6-2.2.4 Junctor Groups of Less Than Ten Junctors

It should be noted that if offices having junctor groups of less than ten junctors, combinations of junctor sequence position, junctor step position, and channel, which do not exist, can be set up on the keys. Also in such offices, if a CH(0-9) key or switch is operated, but the JSQ(0-5) key or switch or the STP1/STP2 key is normal, the CM may progress on successive calls through combinations which do not have junctors corresponding to the operated CH(0-9) keys or switch. In either case, the CM will block and take a trouble record.

K6-2.3 TEST OF FCG AND FCGA RELAYS (FCG KEY OPERATED)

When the HMS1 relay in the CM operates, the HMS1 relay in the MTC is also operated (SFD-K613). The operated MC7 relay extends the TTT and TRT leads from the CM to the MTC (SFD-K621). With the FCG key operated, it imposes an operate test on the FCG relay in the CM by simulating a cross between the tip and ring of the switches.

K6-2.4 FORCING LIGHT OR HEAVY TRAFFIC MARKER TESTS

The CM times for an interval at the end of each call. If another call is started within this interval, the CM handles that call on a heavy traffic basis. If another call is not started until after the interval, the call is handled on a light traffic basis.

The CM can be forced to handle test calls on a heavy traffic basis by operating the HTR key which operates the HTR relay in the CM.

To force the CM to handle test calls on light traffic basis only, the CM must be made busy to eliminate service calls. The test calls then are initiated at great enough intervals to allow the CM to handle them on a light traffic basis.

K6-2.5 CONTROL OF LINE HOLD MAGNET OPERATE PATH

The MT11 relay of the CM is operated on all test calls to split the line hold magnet lead LHM from the LHMT lead. The LHM and LHMT leads are brought into the MTC on test calls to be controlled in several ways.

K6-2.5.1 Simulating Line Hold Magnet Operation

On ORIG class of test with NTC key normal, the CM grounds the LHMT lead to the connector to operate the LHM relay which, in turn, operates the LHMA relay. The operation of the LHM and LHMA relays simulates the operation of a line hold magnet by extending the LHMT lead back to the CM on the LLJ lead and by closing the TTT and TRT leads to the continuity and ground test portion of the MTC (SFD-K621).

K6-2.5.2 Using No-Test Connector

With the NTC key operated (SFD-K614), the MKT2 relay operates the NTC and NTC1 relays. The operation of the NTC and NTC1 relays prepares the MTC for operation with the no-test connector to close the SPC lead to the MTFC over which the F1 relay will be operated when the no-test connector is available to the MTFC, and opens the MC relay operate path, to insure that the F1 relay has operated before the key connecting relays operate to prime the marker (SFD-K105). The operated NTC and NTC1 relays also open the LHM lead of the CM and the operate path of the LHM relay of the MTC and closes the operate path of the NTH relay (SFD-K614) path, opens the tip, ring, and sleeve connections to the originating test line and transfers them to the test frame trunk appearance on the no-test connector (SFD-K614, K621), and connects battery to the EXT lead to extend marker timing because the normal work timer interval of the CM may be exceeded.

When the TS relay has been operated by the MTFC (SFD-J1 part) indicating that the selected CM is available for tests, the no-test connector start battery is closed to the SP lead to the MTFC to operate the SP2 relay. When the SP2 in the MTFC has operated, ground on the SPC lead from the MTFC through the NTC relay operated, operates the F1 relay (SFD-K614).

The operated F1 relay operates a select magnet corresponding to the level of the test frame trunk appearance on each of the no-test connector switches (SFD-K614, K615), which closes the operate path to the MC relay which was opened by the operated NTC relay (SFD-K105), and closes the winding of the NTB relay to the NTH lead to the MTFC.

When the CM has connected to a LL (SFD-K5 part), the winding of the hold magnet on the no-test connector associated with the horizontal group to which the CM is directing its connection, is closed through the LL, the CM, and MTFC, over the NTH lead to the MTC. The NTB relay is connected to the NTH lead and operates if there is ground on the NTH lead, indicating that the no-test connector is busy on the LL to which the connection is being set up.

If the NTB relay operates, it releases the F1 relay which releases the no-test connector select magnets, opens the SP lead to free the no-test connector preference circuit, lights the NTB lamp, and bridges the operate path of the MC relay around make contacts of the F1 relay to prevent releasing the MC relay when the F1 relay is released.

If the no-test connector is busy, the CM blocks because operation of the line hold magnet cannot be simulated. After a timing interval the CM gives a trouble record followed by a trouble release.

When the CM grounds the LHMT lead, the NTH relay operates. The operated NTH relay, if the NTB relay has not operated, closes ground to the NTH lead through the CM and LL to operate the hold magnet of the no-test connector which in turn operates the no-test hold magnets on the LL. The NTH relay also extends the same ground to the H lead to the test circuit trunk appearance on the no-test connector to lock the no-test connector hold magnet, extends the LHMT lead to the S lead and closes the tip and ring leads to the test circuit trunk appearance on the no-test connector.

K6-2.6 CONTINUITY TESTS

Continuity test conditions are imposed on the CM from the time that the CM operates either the LHM and LHMA relays or the NTH relay of the MTC, until the CON relay is operated in the CM. The operated CON relay indicates that the CM has completed continuity test.

K6-2.6.1 Loop Continuity Test (CON Key Operated)

The CON key operated (SFD-K621), connects a resistance bridge to the TTT and TRT leads through the CON relay normal and the MC7 relay operated to make a loop continuity test. When the NTC key is operated, a continuity test is made of the tip and ring leads of the service linkage which the CM sets up.

K6-2.6.2 Tip or Ring Continuity Tests (RV Key Operated or Released)

With the CON key normal (SFD-K621), the continuity test condition is applied to the ring when the RV key is normal, the tip when the RV key is operated. The RV key should normally be set up to apply the continuity test condition to the side of the line which the CM is expected to test.

The marker applies its continuity test to the tip or ring under various conditions. When the MTC indicates that the call is from a tip party (as simulated by the TP key operated), the test is applied to the tip only. Otherwise the ring lead is tested and when the continuity test is not satisfied, then the tip lead.

K6-2.6.3 Polarity of DC Component of Continuity Test - TC Key

The TC key is used for applying negative or positive polarity to the DC component of the current flow test of the marker continuity test feature (SFD-K621). When the TC key is normal, a negative component is applied. When the TC key is operated, a positive component is applied. For a complete test, a call with TC key normal and another call with the TC key operated should be made.

K6-2.7 CONTROLLED CONTINUITY TEST (TCT KEY OPERATED)

The TCT key is used to control the nonoperate and operate test of the marker continuity test feature during a marker test. When this key is operated, the continuity feature is tested for nonoperate and operate under control of timing relays CT1, CT2, CT3, and CT4, and the test is applied to the tip or ring under control of the RV key. The TCT key operation is restricted for use only when ringing voltage used by the CM for continuity test is 86 volts minimum and 87 volts maximum. When the voltage range is not within 86 or 87 volts, the TCT key should not be operated, otherwise false TCT signals will result due to the severity of the nonoperate and operate test conditions imposed with the TCT key operated.

With the TCT key operated, operation of the MC7 relay operates the CT1, CT2, CT3, and CT4 relays in cascade (SFD-K612). Operation of either the LHM or NTH relays opens the operate path to the CT1 relay starting the release of the slow-release CT1, CT2, CT3, and CT4 relays in cascade. Resistance ground is applied to the tip or to the ring under control of the RV key. The value of the resistance depends on the type of ringing machine installed in the office.

Because this test may exceed the work timer interval of the CM, the TCT key connects battery to the EXT lead to extend marker timing.

K6-3 NETWORK CONNECTION (INC CLASS)

On INC class, when the CM has received sufficient information, it establishes a path from the MTC to the location of the simulated trunk.

The crosspoints of the ringing switch are simulated in the MTC.

K6-3.1 LINE IDLE/LINE BUSY AT LINE LINK FRAME

With the LB/LBL key normal, the MTC simulates a line idle condition.

With the LB key operated, a line-busy condition is simulated.

The LBL key operated with a PBX number first gives a line-busy condition and then, after recycle, a line-idle condition at the LL.

K6-3.1.1 Line Idle (LB and LBL Keys Normal)

On the INC class of test, with the LB and LBL keys normal (SFD-K614), the LHMT lead is connected to either the LHM or the NTH relays under control of the NTC key. If the CM makes a line-busy test, it will not find ground on the LHMT lead and will proceed to set up the connection to the line. The operation of a line hold magnet will be simulated or the no-test connector will be used.

K6-3.1.2 Line Busy at Line Link Frame (LBL Key Operated)

The LBL key should be operated only on an INC class of test with PBX number to give first a line-busy condition and then, after recycle, a line-idle condition at line link frame.

The CM makes line idle tests of the PBX numbers through the NG group and, if it finds an idle number, connects to the LL. When the CM checks that it has operated an HG relay in the LL, it operates the HGK relay of the MTC (SFD-K515). This grounds the LHMT lead at the approximate

time that the CM would be connected to the line sleeve if a service call were being handled. The CM, finding a line-busy condition after it had received a line-idle condition via the NG, recycles to test through the NG again. If the CM again finds an idle line, it again connects to the NG and again operates the HGK relay.

When the HGK relay operated the first time, it operated the PU relay which locked to the MC7 relay operated (SFD-K614). When the CM disconnected from the LL, ground was removed from the HGK lead to release HGK relay which removed the shunting ground from the PUL relay to allow it to operate in series with the PU relay. The PUL relay operated, disconnected the LHMT lead from the make contact of the HGT relay and connected it to either the LHM or the NTH relay depending on whether or not the NTC key had been operated.

When the CM makes a busy test, it does not find ground on the LHMT lead and proceeds to set up the connection to the line except that the operation of the line hold magnet is simulated or the no-test connector is used.

K6-3.2 SELECTION OF A PARTICULAR CHANNEL, JUNCTOR SEQUENCE POSITION, AND JUNCTOR STEP POSITION

The CM can be directed to select a particular channel under control of the CH(0-9) key or switch, to select a particular junctor sequence position under control of the JSQ(0-5) keys or switch, and to select a particular junctor step position under control of the STP1/STP2 key. The KCH relay is operated by the MKT1 relay operated (SFD-J107), which makes the features for controlling channel and junctor group selection effective.

K6-3.2.1 Channel Selection

With one of the CH(0-9) key or switch operated (SFD-K608) and the KCH relay operated, the MT7 relay in the CM operates after the MTFC is connected. The MT7 relay opens the operating grounds for the TCH(0-9) relays in the CM. The TCH(0-9) leads are brought into the MTC to contacts of the CH(0-9) key or switch. Ground is extended through the KCH relay, the STP1/STP2 key, and the STP relay for operating the TCH(0-9) relay corresponding to the operated CH(0-9) key or switch. The ground supplied on the TCH(0-9) lead is controlled in the CM by the pattern relays, so that a TCH(0-9) relay cannot be operated in the CM unless that channel is part of the junctor group with which the CM is working. With the CH(0-9) keys normal, or the CH switch in the OFF position, the MT7 relay of the CM is not operated and channel selection is not restricted to advance junctor step position.

K6-3.2.2 Junctor Sequence Position Control

The operation of the JSQ(0-5) key or switch and associated apparatus is covered in SCD-K1-3.2.

K6-3.2.3 Junctor Step Position Control

The STP1/STP2 key is used to allow the CM to find an idle channel in junctor step position 1 or 2 respectfully (SFD-K608).

If no CH(0-9) key is operated or the CH switch is in the OFF position, the CM may select any channel within the junctor step position selected above. Operation of a CH(0-9) key or switch restricts the CM to selection of only that channel within the junctor step position.

With the STP1 key operated, and the KCH relay operated, the MT7 relay in the CM is operated after the MTFC is connected. When the STP1 relay in the CM operates, the STP relay is operated over the STP1 lead. This releases the MT7 relay of the CM if no CH(0-9) key or switch is operated and allows the CM to make channel selection in a normal manner in junctor step position 1. If a CH(0-9) key or switch is operated, the MT7 relay remains operated in the CM. The STP relay operated, closes the ground which was opened by the operated STP1 key to the TCH(0-9) leads through the CH(0-9) key or switch, allowing the CM to select only that channel corresponding to the operated CH(0-9) key or switch. If the CM does not find an idle channel in junctor step position 1, it advances to step 2, releasing the STP1 relay and operating the STP2 relay. This releases the STP relay in the MTC. The STP relay released, reoperates the MT7 relay in the CM, opens the ground to the TCH(0-9) leads through the CH(0-9) keys or switch, and extends the STP2 lead to the TCHK lead to operate the TCHK relay in the CM (SFD-K605). With no TCH(0-9) relays operated, the CM is prevented from selecting any channel in junctor step position 2.

With the STP2 key operated, the MT7 relay is operated and the ground to the TCH(0-9) leads removed during junctor step position 1. During step 2 the STP relay in the MTC operates and the MT7 relay in the CM is released if the CH(0-9) keys are normal or the CH switch is in the OFF position to allow the CM to make normal, unrestricted channel selection. If one of the CH(0-9) keys or switch is operated, the MT7 relay in the CM remains operated. The STP relay operated, supplies ground to the TCH(0-9) lead through the operated CH(0-9) key or switch to restrict the CM to the selection of a channel corresponding to the operated CH(0-9) key or switch. Thus the CM is prevented from finding an idle channel in step 1 but allowed to find one in step 2.

With the STP1 and STP2 keys normal, the CM makes channel selection in step 1 or 2 in normal manner except as restricted by the CH(0-9) keys or switch.

K6-3.2.4 Junctor Groups of Less Than Ten Junctors

It should be noted that in offices having junctor groups of less than ten junctors, combinations of junctor sequence position, junctor step position, and channel, which do not exist, can be set up on the keys. Also in such offices, if a CH(0-9) key or switch is operated, but the JSQ(0-5) key or switch or the STP1/STP2 keys are normal, the CM may progress on successive calls through combinations which do not have junctors corresponding to the operated CH(0-9) key or switch. In either case, the CM will block and take a trouble record.

K6-3.3 TEST OF FCG AND FCGA RELAYS (FCG KEY OPERATED)

When the HMS1 relay in the CM operates, the HMS1 relay in the MTC is also operated (SFD-K613). The operated MC7 relay extends the TTT and TRT leads from the CM to the MTC (SFD-K621). With the FCG key operated, it imposes an operate test on the FCG relay in the CM by simulating a cross between the tip and ring of the switches.

K6-3.4 FORCING LIGHT OR HEAVY TRAFFIC MARKER TESTS

The CM times for an interval at the end of each call. If another call is started within this interval, the CM handles that call on a heavy traffic basis. If another call is not started until after the interval, the call is handled on a light traffic basis.

The CM can be forced to handle test calls on a heavy traffic basis by operating the HTR key which operates the HTR relay in the CM.

To force the CM to handle test calls on light traffic basis only, the CM must be made busy to eliminate service calls. The test calls then are initiated at great enough intervals to allow the CM to handle them on a light traffic basis.

K6-3.5 SIMULATING OPERATION OF TRUNK AND JUNCTOR HOLD MAGNETS

When the CM grounds the TLH lead (SFD-K617), the JHM relay operates simulating the operation of the junctor and trunk hold magnets of the trunk link frame. The JHM relay operated, extends the TLH lead back to the CM on the LLJ lead, simulating closure of the junctor hold magnet sleeve lead.

The JHM relay also extends the TLH lead back to the CM on the BST lead, simulating closure of the trunk hold magnet sleeve lead. When the FB relay in the MTC releases, the BST lead is opened and 10-ohm ground locks to the JHM relay. This ground is extended to SFD-K614 on the LLJ lead, through operated relays, through the LHMT lead to the CM or on no-test calls (NTC1 relay operated), through the line junctor crosspoints and the no-test connector crosspoints and NTH relay over the LHMT lead to the CM.

K6-3.6 CONTROL OF LINE HOLD MAGNET - OPERATE PATH

The MT11 relay in the CM is operated on all test calls to split the line hold magnet lead LHM from the LHMT lead. The LHM and LHMT leads are brought into the MTC on test calls to be controlled in several ways.

K6-3.6.1 Simulating Line Hold Magnet Operation

On INC class of test with NTC key normal, the CM grounds the LHMT lead to operate the LHM relay which, in turn, operates the LHMA relay (SFD-K614). The operation of the LHM and LHMA relays simulates the operation of a line hold magnet by extending the LHMT lead back to the CM on the LLJ lead and by closing the TTT and TRT leads to the continuity and ground test portion of the MTC (SFD-K621).

K6-3.6.2 Using No-Test Connector

With the NTC operated, the MKT2 relay operates the NTC and NTC1 relays (SFD-K614). The operation of the NTC and NTC1 relays prepares the test circuit for operation with the no-test connector to close the SPC lead to the MTFC over which the F1 relay will be operated when the no-test connector is available to the MTC, and opens the MC relay operate path to insure that the F1 relay has operated before the key connecting relays operate to prime the marker (SFD-K105). The operated NTC and NTC1 relays also open the LHM lead to the CM and operate path of the LHM relay of the MTC and closes the operate path of the NTH relay (SFD-K614), opens the tip, ring, and sleeve connections to the originating test line and transfers them to the test frame trunk appearance on the no-test connector (SFD-K614, K621), and connect battery to the EXT lead to extend marker timing because the normal work timer interval of the CM may be exceeded.

When the TS relay has been operated by the MTFC (SFD-J1 part), indicating that the selected CM is available for tests, the no-test connector start battery is closed to the SP lead to the MTFC to operate the SP2 relay. When the SP2 in the MTFC has operated, ground on the SPC lead from the MTFC through the NTC relay operated, operates the F1 relay (SFD-K614).

The operated F1 relay operates a select magnet corresponding to the level of the test frame trunk appearance on each of the no-test connector switches (SFD-K614, K615), closes the operate path to the MC relay which was opened by the operated NTC relay (SFD-K105), and closes the winding of the NTB relay to the NTH lead to the MTFC.

When the CM has connected to a LL (SFD-K5 part), the winding of the hold magnet on the no-test connector associated with the horizontal group to which the marker is directing its connection, is closed through the LL, the CM, the MTFC, via NTH lead to the MTC. The NTB relay is connected to the NTH lead and operates if there is ground on the NTH lead indicating that the no-test connector is busy on the LL to which the connection is being set up.

If the NTB relay operates, it releases the F1 relay which releases the no-test connector select magnets, opens the SP lead to free the no-test connector preference circuit, lights the NTB lamp, and bridges the operate path of the MC relay around make contacts of the F1 relay to prevent releasing the MC relay when the F1 relay is released.

If the no-test connector is busy, the CM blocks because operation of the line hold magnet cannot be simulated. After a timing interval the CM gives a trouble record followed by a trouble release.

When the CM grounds the LHMT lead, the NTH relay operates. The operated NTH relay, if the NTB relay has not operated, closes ground to the NTH lead through the CM and LL to operate the hold magnet of the no-test connector which in turn operates the no-test hold magnets on the LL. The NTH relay also extends the same ground to the H lead to the test circuit trunk appearance on the no-test connector to lock the no-test connector hold magnet, extends the LHMT lead to the S lead and closes the tip and ring leads to the test circuit trunk appearance on the no-test connector.

K6-3.7 CONTINUITY TESTS

Continuity test conditions are imposed on the CM from the time that the CM operates either the LHM and LHMA relays or the NTH relay of the MTC until the CON relay is operated in the CM. The operated CON relay indicates that the CM has completed continuity test.

On INC class of tests, all continuity conditions are applied to the TTT and TRT leads since the incoming trunk is simulated preventing a check through the service linkage if the no-test connector is used.

K6-3.7.1 Loop Continuity Test (CON Key Operated)

The CON key operated (SFD-K621), connects a resistance bridge to the TTT and TRT leads through the CON relay normal and the MC7 relay operated to make a loop continuity test.

K6-3.7.2 Tip or Ring Continuity Test (RV Key Operated or Released)

With the CON key normal (SFD-K621), the continuity test condition is applied to the ring when the RV key is normal, the tip when the RV key is operated. The RV key should normally be set to apply the continuity test condition to the side of the line which the CM is expected to test.

The marker applies its continuity test to the tip or ring under various conditions. When the MTC indicates that the call is from a tip party (as simulated by the TP key operated), the test is applied to the tip only. Otherwise, the ring lead is tested and when the continuity test is not satisfied, when the tip lead is tested.

K6-3.7.3 Polarity of DC Component of Continuity Test

The TC key is used for applying negative or positive polarity to the DC component of the current flow test of the marker continuity test feature (SFD-K621). When the TC key is normal, a negative component is applied. When the TC key is operated, a positive component is applied. For a complete test, a call with TC key normal and another call with the TC key operated should be made.

K6-3.8 CONTROLLED CONTINUITY TEST (TCT KEY OPERATED)

The TCT key is used to control the nonoperate and operate test of the marker continuity test feature during a marker test. When this key is operated, the continuity feature is tested for nonoperate and operate under control of timing relays CT1, CT2, CT3, and CT4, and the test is applied to the tip or ring under control of the RV key. The TCT key operation is restricted for use only when ringing voltage used by the marker for continuity test is 86 volts minimum and 87 volts maximum. When the voltage range is not within 86 to 87 volts, the TCT key should not be operated, otherwise false TCT signals will result due to the severity of the nonoperate and operate test conditions imposed with the TCT key operated.

With the TCT key operated, operation of the MC7 relay operates the CT1, CT2, CT3, and CT4 relays in cascade (SFD-K612). Operation of either the LHM or NTH relays opens the operate path to the CT1 relay starting the release of the slow release CT1, CT2, CT3, and CT4 relays in cascade. Resistance ground is applied to the tip or to the ring under control of the RV key (SFD-K621). The value of the resistance depends on the type of ringing machine installed in the office.

Because this test may exceed the work timer interval of the CM, the TCT key connects battery to the EXT lead to extend marker timing.

K6-3.9 SIMULATED RINGING SWITCH SELECT MAGNETS

The KRS relay in the MTC is operated by the F relay (SFD-K622) and closes RS(0-9) leads from the CM to windings of the RS(0-9) relays in the MTC which simulate ringing switch select magnets.

The CM normally grounds the RS0 or RS1 lead and one of the RS(2-9) leads, operating the corresponding relays which lock on secondary windings to ground on the RSH relay. Any of the RS(0-9) relays operated, grounds the RSK lead to the CM.

Lamps are lighted by the operated RS(0-9) relay to indicate the ringing condition which would have been set up by a ringing switch.

SECTION K, PART 7
MARKER DISCONNECT AND
TEST FRAME RESTORED TO
NORMAL

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K7 MARKER DISCONNECT AND TEST FRAME RESTORED TO NORMAL

The K7 part of the SCD covers the release of the marker. The test frame may have the REC key operated or released. If the REC key is operated, the trouble recorder is seized after the DCT in the MTC operates. If the REC key is normal when the DCT relay in the MTC operates, the MO1 relay in the MTC operates and the marker starts to disconnect.

The RL key at the MTC is operated when it is desirable to restore the test circuits to normal.

K7-1 DIAL TONE MARKER DISCONNECT

When the DTM has completed its double connection test, it proceeds to disconnect. If the REC key is operated, the DTM will seize the trouble recorder and force a trouble record before it disconnects. If the REC key is normal the DTM will proceed with disconnect and will take a trouble record only if it encounters trouble.

K7-1.1 OPERATION OF THE DCT RELAY

A marker test relay operated in the DTM splits the operate path of the DCT1 relay. Both ends of this lead (DCT and TDCT leads) are brought into the MTC (SFD-K708). The operation of the DCT relay in the DTM operates the DCT relay in the MTC, as a signal that the DTM has completed all of its functions of setting up a connection and is about to start to release connecting circuits preparatory to giving a release signal to the MTC.

If the REC key is operated the DCT operating causes the DTM to make a bid for the trouble recorder. The DCT relay in the MTC operates the MO1 relay if the REC key is normal.

K7-1.2 TROUBLE RECORD (REC KEY OPERATED)

The REC key is operated when it is desired to obtain a record of the progress of the DTM being tested. The DTM is not prevented from giving a record of any condition which would cause it to take a record in service but is forced to give a record on tests when it has reached a predetermined progress point. In order to distinguish trouble records which are forced by the MTC, the REC relay is operated which extends its operate ground to the DTM to operate the TRR relay (SFD-K708). This relay causes the trouble recorder to be connected. On actual trouble the TR1 relay in the DTM is operated.

When the REC relay operates, it removes ground from the TI lead so that no TI punch (trouble indication) will be perforated on the trouble recorder card. Cards which are perforated on test calls as a result of conditions which would result in trouble records in service will perforate a TI indication.

When the DTM operates the DCT relay in the MTC, it operates the REC relay, which in turn operates the TRR relay in the DTM. The TRR operated operates the TRST relay for a trouble start to the recorder. If the recorder is idle a trouble record is taken. When the record is completed the TRB relay of the marker is operated to ground the M01 lead operating the M01 relay in the MTC.

Also with the REC key operated a trouble record will be forced which will perforate OBS1 and OBS2 punches. The OBS1 indicates that the DTM received an observe signal. The OBS2 indicates that the DTM passes the signal to the OR.

K7-1.3 OPERATION OF M01 RELAY

When the M01 relay operates (SFD-K708), it extends the DCT lead back to the DTM by grounding the TDCT lead, operating the DCT1 relay in the DTM which would normally have operated directly from the marker DCT relay. This permits the DTM to continue its functions.

K7-1.4 OPERATION OF LK2 AND DIS1,2 RELAYS

When the DTM has successfully completed setting up a connection, it normally operates its disconnect relays DIS1 and DIS2 (SFD-K708). However, the DTM may operate these relays over several paths. To determine in which way the marker operates these relays, the operate path is split in two places and the leads are brought to the MTC.

When the DTM grounds the operate path of the disconnect relays after setting up a successful connection, the LK2 relay in the MTC operates over the LK2 lead from the DTM. The operated LK2 relay lights the LK2 lamp and extends the marker DIS1 and 2 relay operate path from the LK2 lead back to the marker over the LK3 lead. This path is split again in the DTM and brought back to the MTC as the DIS1 lead. Ground on this lead operates the DIS1,2 relays in the MTC. Under some conditions the DTM may ground this lead directly in which case the LK2 relay in the MTC is not operated.

When the DIS1 relay in the MTC operates, it lights the DIS1 lamp and extends ground, through the REC key normal, over the DIS lead to operate the marker DIS1 and DIS2 relays. When the REC key is operated, a trouble record may be taken.

It will be noted that if LK2 and DIS1 lamps are both lighted, it is an indication that the marker has completed setting up a connection. The DIS1 lamp alone is an indication that the marker has attempted to release without having completed setting up a connection either because it has only a translation job to do or because of some condition causing it to give a regular release prematurely.

If the LK2 relay has operated before the DIS1 relay operates, the DIS lead to the DTM is grounded regardless of REC key position and no record is then taken.

K7-1.5 OPERATION OF THE MRL RELAY

When the DTM grounds the MRL lead (SFD-K708), with the DIS2 relay operated, the MRL of the MTC operates. The operated MRL relay lights the MRL lamp. The MTC, therefore, recognizes the MRL ground but does not accept it as a release signal. It waits for a regular release.

K7-1.6 REGULAR RELEASE

The regular release signal from the DTM is the opening of the OC1 lead which releases the MS relay in the MTC (SFD-J106).

The release of the MS relay operates the MFC relay (SFD-K712) and opens the operate path of the MS1 relay (SFD-J106) which remains locked to the MC2 relay in order to prevent transferring ground from the CKG2 lead (dial tone marker) to the CKG1 lead (completing marker).

K7-1.7 OPERATION OF MFC AND MFC1,2 RELAYS

When the MFC relay operates (SFD-K712) in recognition that marker functions are completed, it locks to the TS relay which remains operated until the MTFC restores to normal. The MFC operates the MFC1,2 relays. The operated MFC1 relay starts the release of MTFC multicontact relays by opening the CIB lead (SFD-J108, J112), opens the start battery to the MTFC over the MTP to restore the connector to normal (SFD-J108, J112), removes battery from the SP lead to the MTFC to release no-test connector when used (SFD-K614), and releases MC relay which in turn releases the various TS- connecting relays (SFD-K104).

K7-1.8 TROUBLE RELEASE

The DTM has two trouble release leads TRL and BT which are extended to the MTC (SFD-K712). In general it grounds the TRL lead when it expects the circuit which seized it to make a second trial and grounds the BT lead when it does not expect the circuit which seized it to make a second trial.

When the marker grounds the TRL lead to give a trouble release, the TRL relay of the MTC is operated, which lights the TRL lamp and operates the MFC relay.

When the marker grounds the BT lead to give a trouble release, the BT relay of the MTC is operated, which lights the BT-OF lamp and operates the MFC relay.

K7-1.9 TEST FRAME RESTORED TO NORMAL (RL KEY OPERATED)

Operating the release key at any time operates the KR and KR1 relays which lock to make contacts on a number of relays in the MTC to insure that the circuit restores to normal before another test can be started (SFD-J109, J113). The KR and KR1 relays remove normal ground to which various relays of the MTC have operated and locked.

If the KR relay is operated before the MFC relay operates, the MFC1 is operated to release the MTFC and the no-test connector by opening their start battery leads.

K7-2 COMPLETING MARKER DISCONNECT (ORIG CLASS)

When the CM has completed its double connection test, it proceeds to disconnect. If the REC key is operated, the CM will seize the trouble recorder and force a trouble record before it disconnects. If the REC key is normal the CM will proceed with disconnect and will take a trouble record only if it encounters trouble.

K7-2.1 OPERATION OF THE DCT RELAY

A Marker Test (MT17) relay, operated in the CM on test calls, splits the DCT lead from the make contact of the marker DCT relay (SFD-K710). Both ends of the DCT and TDCT leads are brought into the MTC. When the DCT relay in the CM operates, it operates the DCT relay in the MTC, which is a signal that the CM has completed all of its functions of setting up a connection and is about to start to release connecting circuits preparatory to giving a release signal to the MTC. If the REC key is operated, a trouble record is taken. The operation of the DCT relay of the MTC, if the REC key is normal, operates the M01 relay (SFD-K711).

K7-2.2 TROUBLE RECORD (REC KEY OPERATED)

The REC key is operated when it is desired to obtain a record of the progress of a CM being tested or a CM being used to set up a test connection. The CM is not prevented from giving a record of any condition which would cause it to take a record in service, but is forced to give a record on OK tests when it has reached a predetermined progress point.

In order to distinguish trouble records which are forced by the MTC, the windings of the REC relay are connected so that the relay operates and extends its operate ground to operate one of two relays in the CM whenever the MTC forces a trouble record. When the REC relay operates, it removes ground from the TI lead so that no Trouble Indication (TI) will be perforated on the trouble record card. Cards which are perforated on test calls as a result of conditions which would result in trouble records in service will show a TI punch.

When the CM operates the DCT relay in the MTC, ground is extended through contacts of the REC key operated to operate the REC relay (SFD-K711), which extends the TRR lead to operate the TRR relay in the CM. The operation of this relay causes the trouble recorder to be connected. When the record is complete the TRB1,2 relays in the CM are operated to ground the MO1 lead. The MO1 relay of the MTC operates, which extends the TDCT lead back to the CM. The DCT relay is operated twice on intra-office calls, causing a record to be taken on both stages.

K7-2.3 OPERATION OF MO1 RELAY

When the MO1 relay operates, it extends ground from the operated DCT relay in the MTC to the CM, operating the DCT1 relay which would normally have operated directly from the DCT relay in the CM. This permits the CM to continue its functions.

If the CM sets up an intraoffice connection, the DCT and MO1 relays are operated during the terminating stage, released, and are operated a second time during the call-back stage.

K7-2.4 OPERATION OF LK2 AND DIS1,2 RELAYS

When the CM has successfully completed setting up a connection, it normally operates its disconnect relays DIS1 and DIS2 (SFD-K711). However, the CM may operate these relays over several paths. To determine in which way the CM operates these relays, the operate path is split in two places and the leads are brought to the MTC.

When the CM grounds the operate path of the disconnect relays after setting up a successful connection, the LK2 relay in the MTC operates over the LK2 lead from the CM (SFD-K711). The operated LK2 relay lights the LK2 lamp and extends the marker DIS1 and 2 relay operate paths from the LK2 lead back to the CM over the LK3 lead. This path is split again in the CM and brought back to the MTC as the DIS1 lead. Ground on this lead operates the DIS1,2 relays in the MTC. Under some conditions the CM may ground this lead directly, in which case the LK2 relay in the MTC is not operated.

When the DIS1 relay in the MTC operates, it lights the DIS1 lamp and extends ground through the REC key normal and over the DIS lead to operate the marker DIS1 and DIS2 relays. When the REC key is operated, a trouble record may be taken.

It will be noted, that if LK2 and DIS1 lamps are both lighted it is an indication that the CM has completed setting up a connection. The DIS1 lamp alone is an indication that the CM has attempted to release without having completed setting up a connection either because it had only a translation job to do or because of some condition causing it to give a regular release prematurely.

If the LK2 relay has operated before the DIS1 relay operates, the DIS lead to the marker is grounded regardless of REC key position and no record is taken.

K7-2.5 OPERATION OF THE MRL RELAY

When the CM grounds the MRL lead (SFD-K713), with the DIS2 relay operated, the MRL in the MTC operates. The operated MRL relay lights the MRL lamp. The MTC, therefore, recognizes the MRL ground as a regular release signal.

K7-2.6 REGULAR RELEASE

The regular release signal from the marker is grounding of the MRL lead. On test calls, this operates the MRL relay in the MTC. The MRL operated, locks, lights the MRL lamp, and operates the MFC relay.

K7-2.7 OPERATION OF MFC AND MFC1,2 RELAYS

When the MFC relay operates (SFD-K713) in recognition that marker functions are completed, it locks to the TS relay, which remains operated until the MTFC restores to normal, and operates the MFC1 relay. The MFC1 operated starts the release of MTFC multicontact relays by opening the CIB lead (SFD-J108, J112), opens the start battery to the MTFC over the MTP lead to restore the connector to normal, (SFD-J108, J112), removes battery from the SP lead to the MTFC to release no-test connector when used (SFD-K614), and releases MC relay, which in turn releases the various key connecting relays.

K7-2.8 TROUBLE RELEASE

When the CM encounters a condition which causes it to give a trouble release instead of a regular release, it will ground the BT or the TRL lead (SFD-K713). In general, it grounds the TRL lead when it expects the circuit, which seized it, to make a second trial and grounds the BT lead when it does not expect the circuit, which seized it, to make a second trial.

When the CM grounds the TRL lead to give a trouble release, the TRL relay in the MTC is operated. The TRL relay operated, lights the TRL lamp and operates the MFC relay.

When the CM grounds the BT lead to give a trouble release, the BT relay operates, which lights the BT-OF lamp and operates the MFC relay.

K7-2.9 TROUBLE RECORD (REC KEY NORMAL)

The CM being tested will connect to the trouble recorder to give a record if it encounters any condition which would cause it to give a trouble record in service. If it does not encounter such a condition, the CM releases without a record.

K7-2.10 TEST FRAME RESTORED TO NORMAL (RL KEY OPERATED)

Operating the release key at any time operates the KR and KR1 relays, which lock to make contacts on a number of relays in the MTC to insure that the circuit restores to normal before another test can be started (SFD-J109, J113). The KR and KR1 relays remove normal grounds to which various relays of the MTC have operated and locked.

If the KR relay is operated before the MFC relay operates, the MFC1 relay is operated to release the MTFC and the no-test connector by opening their start battery leads.

K7-3 COMPLETING MARKER DISCONNECT (INC CLASS)

When the CM has completed its double connection test, it proceeds to disconnect. If the REC key is operated, the CM will seize the trouble recorder and force a trouble record before it disconnects. If the REC key is normal the CM will proceed with disconnect and will take a trouble record only if it encounters trouble.

K7-3.1 OPERATION OF THE DCT RELAY

A MT17 relay, operated in the CM on test calls, splits the DCT lead from the make contact of the marker DCT relay. Both ends of the DCT and TDCT leads are brought into the MTC. When the DCT relay of the CM operates, it operates the DCT relay in the MTC which is a signal that the CM has completed all of its functions of setting up a connection and is about to start the release of connecting circuits preparatory to giving a release signal to the circuit which seized the marker. If the REC key is operated, a trouble record is taken. The operation of the DCT relay in the MTC, if the REC key is normal, operates the M01 relay (SFD-K711).

K7-3.2 TROUBLE RECORD (REC KEY OPERATED)

The REC key is operated when it is desired to obtain a record of the progress of a CM being tested or a CM being used to set up a test connection. The CM is not prevented from giving a record of any condition which would cause it to take a record in service but is forced to give a record on trouble-free tests when it has reached a predetermined progress point.

In order to distinguish trouble records which are forced by the MTC, the windings of the REC relay are connected so that the relay operates and extends its operate ground to operate one or two relays in the CM when-even the MTC forces a trouble record. When the REC relay operates, it removes ground from the TI lead so that no TI will be punched on the trouble record card. Cards which are punched on test calls as a result of conditions which would result in trouble records in service will show a TI indication.

When the CM operates the DCT relay in the MTC, ground is extended through contacts of the REC key operated to operate the REC relay (SFD-K711), which extends the TRR lead to operate the TRR relay in the CM. This relay causes the trouble recorder to be connected. When the record is complete, the TRB1,2 relays in the CM are operated to ground the M01 lead, operating the M01 relay of the MTC which extends the DCT lead back to the CM.

K7-3.3 OPERATION OF THE M01 RELAY

When the M01 relay operates, it extends the DCT lead from the CM through contacts of the DCT relay operated, to the TDCT lead, operating the DCT1 relay in the CM which would normally have operated directly from the marker DCT relay. This permits the CM to continue its functions.

K7-3.4 OPERATION OF LK2 AND DIS1,2 RELAYS

When the CM has successfully completed setting up a connection, it normally operates its disconnect relays DIS1 and DIS2 (SFD-K711). However, the marker may operate these relays over several paths. To determine in which way the CM operates these relays, the operate path is split in two places and the leads are brought to the MTC.

When the CM grounds the operate path of the disconnect relays after setting up a successful connection, the LK2 relay in the MTC operates over the LK2 lead from the CM (SFD-K711). The operated LK2 relay lights the LK2 lamp and extends the DIS1 and 2 relay operate paths from the LK2 lead back to the CM over the LK3 lead. This path is split again in the CM and brought back to the MTC as the DIS1 lead. Ground on this lead operates the DIS1 relay in the MTC. Under some conditions, the CM may ground this lead directly, in which case the LK2 relay in the MTC is not operated.

When the DIS1 relay in the MTC operates, it lights the DIS1 lamp; it extends ground through the REC key normal and over the DIS1 lead to operate the marker DIS1 and DIS2 relays. When the REC key is operated, a trouble record may be taken.

It will be noted that if LK2 and DIS1 lamps are both lighted, it is an indication that the CM has completed setting up a connection. The DIS1 lamp alone is an indication that the CM has attempted to release without having completed setting up a connection either because it had only a translation job to do or because of some condition causing it to give a regular release prematurely.

If the LK2 relay has operated before the DIS1 relay operates, the DIS lead to the CM is grounded regardless of REC key position and no record is taken.

K7-3.5 OPERATION OF THE MRL RELAY

When the CM grounds the MRL lead (SFD-K713), with the DIS2 relay operated, the MRL in the MTC operates. The operated MRL relay lights the MRL lamp. The MTC, therefore, recognizes the MRL ground as a regular release signal.

K7-3.6 REGULAR RELEASE

The regular release signal from the marker is the grounding of the MRL lead. On test calls, this operates the MRL relay of the MTC. The MRL operated, locks, lights the MRL lamp, and operates the MFC relay.

K7-3.7 OPERATION OF MFC AND MFC1,2 RELAYS

When the MFC relay operates (SFD-K713) in recognition that CM functions are completed, it locks to the TS relay, which remains operated until the restores to normal, and operates the MFC1,2 relays. The MFC1 operated starts the release of MTFC multicontact relays by opening the CIB lead (SFD-J108, J112), opens the start battery to the MTFC over the MTP lead to restore the connector to normal (SFD-J108, J112), removes battery from the SP lead to the MTFC to release no-test connector, when used (SFD-K614), and releases MC relay which in turn releases the various key connecting relays.

K7-3.8 TROUBLE RELEASE

When the CM encounters a condition which causes it to give a trouble release instead of a regular release, it will ground the BT or the TRL lead (SFD-K713). In general, it grounds the TRL lead when it expects the circuit which seized it to make a second trial and grounds the BT lead when it does not expect the circuit which seized it to make a second trial.

When the CM grounds the TRL lead to give a trouble release, the TRL relay in the MTC is operated. The TRL relay operated, lights the TRL lamp and operates the MFC relay.

When the CM grounds the BT lead to give a trouble release, the BT relay operates, which lights the BT-OF lamp and operates the MFC relay.

K7-3.9 TROUBLE RECORD (REC KEY NORMAL)

The CM being tested will connect to the trouble recorder to give a record if it encounters any condition which would cause it to give a trouble record in service. If it does not encounter such a condition, the CM releases without a record.

K7-3.10 TEST FRAME RESTORED TO NORMAL (RL KEY OPERATED)

Operating the release key at any time operates the KR and KR1 relays which lock to make contacts on a number of relays in the MTC to insure that the circuit restores to normal before another test can be started (SFD-J109, J113). The KR and KR1 relays remove normal grounds to which various relays to the MTC have operated and locked.

If the KR relay is operated before the MFC relay operates, the MFC1 relay is operated by the KR relay to release the MTFC and the no-test connector by opening their start battery leads.

K7-3.11 MARKER TROUBLE RECORD UPON RELEASE OF NTR RELAY USING NO-TEST
TRAIN

Test relays, operated in the CM, open up the normal operate path of the LK1 relay through the released NTR relay on no-test train calls. Instead, this operating ground is brought into the MTC on the NTR lead to operate the NTR relay.

If the REC key is normal, this operates the MO1 relay which grounds the LK1 lead to advance the CM.

If the REC key is operated, operation of the NTR relay operates the REC relay which extends ground to the TRR lead to signal the CM to take a trouble record. Upon completion of the trouble record, the CM operates the test circuit MO1 relay which closes ground to the LK1 lead to advance the CM.

K7-3.12 REORDER

The RO key is operated to simulate a request for reorder by the incoming register. When the RO key is operated, no button should be operated on the IC key or switch. When the KINC relay operates, the RO lead is grounded to signal the CM to set up reorder.

When the CM sets up reorder in an incoming trunk, it sets up the ringing switch to give overflow tone. The RS0 and RS9 relays are operated which lights the OFL lamp. The DIS1 and MRL lamps should be lighted.

SECTION K, PART 8
PRETRANSLATOR CLASS OF TEST

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K8 PRETRANSLATOR CLASS OF TEST

The pretranslator may be tested from the MTC circuit over paths closed by the MTFC circuit. The operation of the circuit on test calls is as previously described for regular calls (SFD-B6). The receiving lead grounds and other incoming signals to the PRT are provided by the MTC, and the outgoing signals are returned to it to light lamps at the MTC. The pretranslator connector is not involved in these calls.

If a test call is started while the PRT is busy on a service call, the test connection is delayed until the service call is completed. The busy condition in this case is indicated by ground on the TM lead to the MTFC.

K8-1 SELECTION OF PRETRANSLATOR

The maintenance section of the SFD and SCD covers the use of both MTFC (SD-25805-01, SD-27718-01). The selection of pretranslators through the preference circuit of the MTFC is covered in the following two paragraphs.

K8-1.1 SELECTION OF A PRETRANSLATOR USING SD-25805-01 (SFD-J108,J109)

Closure of start battery on the Test Preference (PTP) lead to the MTFC operates a PTP relay. Ground at the break contact of the MON relay through other preference relays through PTP relay operates the PTP1. The PTP1 relay connects ground to the PTS lead when Pretranslator Test (PTT-) relays are normal through make contact of the first operated MT-key or MTU- switch associated with an equipped pretranslator, to the corresponding PTT(0-2) lead to operate the PTT(0-2) relay in the MTFC for the PRT selected. The MTFC makes that PRT service busy and, after verifying that the PRT is test normal, closes relays to the PRT.

K8-1.2 SELECTION OF A PRETRANSLATOR USING SD-27718-01 (SFD-J112-J115)

Closure of start battery on the PTP lead to the MTFC operates a PTP relay (SFD-J112). Ground at the fixed contact of LTP1 relay (SFD-J115), through preference relays normal, through the make contact of PTP relay, operates the PTP1 relay. The PTP1 relay connects ground to the PTS lead when PTT- relays are normal through the make contact of the first operated MT- key or MTU- switch associated with an equipped pretranslator to the corresponding PTT(0-2) lead to operate the PTT(0-2) relay in the MTFC for the pretranslator selected. The MTFC makes that PRT service busy by operating the MB relay in the PRT (SFD-J117) and after verifying that the PRT is test normal, closes relays to the PRT. The PTP1 relay grounds the TS lead to the MTC (SFD-J119).

K8-2 SIGNAL TO OPERATE KEY CONNECTING RELAYS

Ground on the TS lead from the MTFC operates the TS relay in the MTC (SFD-J119) which operates the PC1 relay through previously operated PT1 and SR relays (SFD-K810). The PC1 relay operates KA, KB, and KC relays (SFD-K804) to closed through the A, B, and C key or switch contacts and operates the PC2 relay and, if OT and PTR keys are normal, operates the PC3 relay (SFD-K810).

Relays PC1, PC2, and PC3 are connecting relays which close leads from the MTFC to the pretranslator and also furnish grounds to the TR2/TRS key and to the 11 key or the TRNA switch which control the grounds applied to the TR2, TRS LT, and 11 leads (SFD-K804, K810)

K8-3 REGULAR PRETRANSLATOR TEST

When the pretranslator receives an ABC code and a ground on the LT or the 11 lead and has translated the code accordingly, it returns ground on one or more of the transmitting leads SD, CM3, CMA, CMB, or CMC through low-resistance continuity check relays. These grounds operate corresponding relays in the MTC and light lamps (SFD-K807).

K8-3.1 TRANSLATION

The following paragraphs describe the cross-connection for this circuit and the operation of the translation features for home area office codes in areas where all such codes consist of three digits. The translation for X11 codes, 11 foreign area directing codes and restricted codes, and the treatment of certain vacant codes as applying to all areas, is also described.

As a result of translation, ground is connected to one of a maximum of 10 transmitting punchings BS- and CM- (SFD-K807), the punching used for each code being in accordance with local requirements. These punchings represent start indexes and control the transmission of information to the originating register (to the MTC on test calls) as follows:

- (a) Point BSS represents the basic setting. It is used also for foreign areas requiring the same total number of digits, exclusive of an 11 prefix.
- (b) Point BSP provides for the number of digits corresponding to the basic setting with station delay. It is used for codes to manual offices with station letters, having party lines which require this setting.*

* Since there are now few if any No. 5 Crossbar offices having dial access to manual offices, these cross-connections are seldom used.

- (c) The CMS3 signals the register to call the marker, without returning a coin, after 3 digits have been dialed.
- (d) The CMP3 signals the register to call the marker after 3 digits have been dialed, but before doing so it signals the register to return the coin on coin lines.
- (e) The CMSA and CMSB are used for additional settings and may represent any numbers of digits, except ten, without stations delay, as determined by the originating register cross-connections.
- (f) The CMSC is used for additional settings and may represent any numbers of digits, including ten, without stations delay as determined by the originating register cross-connections.
- (g) The CMPA, CMPB, and CMPC represent the same numbers of digits as for the corresponding S punchings, but in addition set the register for stations delay.*

The operations involved in transmitting the previous information and additional features of the circuit are covered in the following sections.

K8-3.2 METHOD OF TRANSLATION (SFD-K806)

Since practically all No. 5 Crossbar offices are now arranged to use only 3 digit office codes, neither this SCD nor the SFD show 2 digit code options.

If local translation is required on a call (LT[†] relay operated by MTC) the pretranslator translates the 3 digit office code comprised of the A digits 2-9, the B digit 0-9, and the C digit 1-9 (or 0-9 if the office is arranged to use office codes with 0 in C digit).

The B digit which is received in a 2/5 code is translated into a 1/10 code to operate one of the sets of relays B0, BA0, CZ0 through B9, BA9, and CZ9 (SFD-K806). The three relays operated in series are required to provide sufficient contacts to perform subsequent portions of the over-all translation.

Numbers 1 through 9 of the C digit is translated into two separate 1/3 codes (SFD-K806) as follows:

* Since there are now few if any No. 5 Crossbar offices having dial access to manual offices, these cross-connections are seldom used.

† In some cases, only local translation is required and the LT relay is not provided. In this case, most of the leads which would go through its contacts are looped.

<u>C Digit</u>	<u>Relay</u>	<u>C Digit</u>	<u>Relays</u>
1, 2, or 3	CR	1, 4, or 7	CU, CUA
4, 5, or 6	CS	2, 5, or 8	CV, CVA
7, 8, or 9	CT	3, 6, or 9	CW, CWA

The 0 of the C digit is translated to operate the CZC relay if the office is arranged to use office codes with 0 in the C digit. If the office is not arranged to use office codes with 0 in the C digit, the 0 translation grounds the VCR terminal which, as will be covered later, is cross-connected to treat 0 in the C digit as a vacant code.

Translation of the A digit is combined with the results of the previous two translations. (It should be noted that there will never be a 0 or 1 in the A digit when local translation is required since the OR will not connect to a pretranslator if there is a 0 in the A digit and will not store a 1 in the A digit.*) The first portion of this translation (SFD-K806) results in grounding of one of the terminals 20R through 99T or (if the office uses codes with 0 in the C digit) one of the terminals 200 through 990 is grounded.

Each of the 80 terminals 200 - 990 represents an individual code with a C digit 0.

Each of the 240 terminals 20R through 99T represents any of 3 codes as follows:

The first digit of the terminal designation is the A digit, the second is the B digit, and the letter indicates the C digit as below:

R = C1, 2, or 3
 S = C5, 5, or 6
 T = C7, 8, or 9

Further translation of this output is required to sort each code into 1 of 3 categories. For this purpose, there is provision for cross-connection from the 20R through 99T terminals to terminals P0-26.

Typical cross-connections are shown on SFD-K806.

Assume that each of codes 291, 292, and 293 represented by terminal 29R (SFD-K806) require that the OR wait for 7 digits. Refer to Table A of Note 2 on SFD-K809. Terminal 29R should be cross-connected to terminal P0.

Assume that of the three codes represented by terminal 20S:

* This is not true if two digits 1 are dialed first as a directory code. In this case, however, the OR will signal the pretranslator for use of the 11 translator rather than the LT translator.

204 is an area code requiring 10 digits.
 205 is an area code to a manual office which may require
 either 10 or 11 digits.†
 206 is a vacant area code (3 digits).

Refer to Table B of Note 2 on SFD-K809. Terminal 20S should be cross-connected to terminal P5. (Code 204 will be closed to terminal W1 by operation of the CU relay; code 205 will be closed to terminal W2 by the CV relay; and code 206 will be closed to terminal W3 by the CW relay.)

Similarly, if it is assumed that the three codes associated with terminal 92T are all vacant office codes (3 digits), Table A of Note 2 on SFD-B610 shows that terminal 92T should be cross-connected to terminal P26 which connects directly to the W3 terminal.

If the office does not use area codes, the W1, W2, and W3 terminals are cross-connected to BS- or CM- terminals (K807) in accordance with Note 1 on SFD-K809. Since most offices do use area codes, the columns in tables associated with offices which do not use office codes have been cross-hatched.

K8-3.2.1 Segregation of Office Codes and Area Codes

In offices which use area codes, a further translation is required to handle office codes and area codes differently.* In this case terminal W1 is connected to WA and W2 is connected to WB. If the B digit is either 0 or 1, the CZ0 or CZ1 relay connects the W1 terminal to W5 and the W2 terminal to W7. If the B digit is 2-9, the CZ2-9 relays connect the W1 terminal to W4 and the W2 terminal to W6. Cross-connections from the W3, W4, W5, W6, and W7 terminals should be made as shown in Note 1 of SFD-K809.

K8-3.2.2 Codes With 0 in C Digit

As previously mentioned, codes with 0 in the C digit cause one of the 80 terminals 200-990 to be grounded. These terminals should be cross-connected as shown in Note 1 of SFD-K809.

† Even though there are few if any manual offices left, this example is used to illustrate the additional flexibility that is still included in the pretranslator even though no longer required.

* Generally area codes can be distinguished from office codes because they have either 0 or 1 in the B digit. Eventually it is planned that office codes and area codes will be interchangeable; that is, any combination of 3 digits could be either an office code or an area code. Interchangeable codes will not be covered in this issue of the SFD or SCD.

K8-3.2.3 3-Digit Service or Operator Codes X11

Whenever the B digit and the C digit are both 1, the regular B and C digit translators are disabled since they both require that either a BC1, 4, or 7, or a CC1, 4, or 7 relay be operated and neither will be operated if both the B and C digits are 1 (SFD-K806). Instead the X11 terminal is grounded regardless of what the A digit is. All X11 codes are either 3-digit service calls or vacant codes and are handled in the same manner. Terminal X11 should be cross-connected as shown in Note 1 of SFD-K809.

K8-3.2.4 Foreign Area Directing Codes†

When the MTC grounds the 11 lead instead of the LT lead, the LT translator is not enabled. Instead, translation of the A digit causes one of the terminals 11X0-9 to be grounded. These terminals should be cross-connected in accordance with Note 1 of SFD-K809.

K8-3.3 INFORMATION TRANSMITTED TO MTC

As previously described the translation of a code causes ground to be connected to one of a maximum of 10 transmitting punchings BX- and CM-. These punchings are used as follows for transmitting information to the register (to the MTC on test calls).

- (a) Point BSS represents the basic setting for 7 digits. It is used also for foreign areas requiring 7 digits, exclusive of an 11 prefix.
- (b) Point BSP‡ provides for the number of digits corresponding to the basic setting with stations delay. It is used for manual offices and foreign areas requiring this setting.
- (c) The CMS3 signals the register to call the marker, without returning a coin, after 3 digits have been dialed. It is used for vacant and for X11 service codes and ABX manual straightforward codes if the register is not to return a coin before calling the marker.

† The use of the 11 digits as directing codes has diminished to the point that very few No. 5 Crossbar offices still use it. For this reason the portion of the table in Note 1 of SFD-K809 relating to 11X directing codes has been cross-hatched.

‡ Terminals BSP, CMPA, CMPB, and CMPC provide stations delay which is only required for codes to manual offices. Few if any No. 5 Crossbar offices still require stations delay.

- (d) The CMP3 signals the register to call the marker after 3 digits have been dialed, but before doing so to return the coin on coin lines. It is used for vacant codes and X11 service codes, and for X11 and ABX manual straightforward codes when they require this feature.
- (e) The CMSA and CMSB are used for additional settings and may represent any numbers of digits except ten without stations delay, as determined by originating register cross-connections.
- (f) The CMSC is used for additional settings and may represent any numbers of digits, including ten, without stations delay, as determined by the originating register cross-connections.
- (g) The CMPA*, CMPB*, and CMPC* represent the same numbers of digits as for the corresponding S punchings, but in addition set the register for stations delay.

Closure of ground to one of the above punchings causes one of relays BS, CM3, CMA, CMB, or CMC, and one of relays SW or PW to operate in series with the primary winding of XR, to battery through TM relay operated. The XR relay does not operate except under trouble conditions as described later. The SW relay operates if the secondary winding of the BS relay or a CM- relay is involved. If it operates, it, in turn, operates SW1. The PW relay operates, operating PW1, if the primary winding of BS or CM- is used.

If one of the relays CM3, CMA, CMB, or CMC operates, it closes ground through the winding of CCM, normal contacts of KTR, through its own operated contacts, to the correspondingly designated lead to the MTFC. If the PW1 relay operates, ground is closed through the winding of CSD, normal contacts of KTR, operated contacts of PW1, to the SD lead to the MTFC. Double contacts, connected in series or in parallel, are used at a number of points in this circuit to guard against failures which would otherwise occur because of a locked contact or an open contact. This applies in particular to failures in the checking features which would make them inoperative.

* Terminals BSP, CMPA, CMPB, and CMPC provide stations delay which is only required for codes to manual offices. Few if any No. 5 Crossbar offices still require stations delay.

The association of the aforementioned terminals, relays, and leads are as shown in Table E

TABLE E

Punchings	Relays Operated	Leads Closed
BSS	BS, SW, and SW1	None
BSP	BS, PW, and PW1	SD
CMS3	CM3, SW, and SW1	CM3
CMP3	CM3, PW, and PW1	CM3, SD
CMSA	CMA, SW, and SW1	CMA
CMPA	CMA, PW, and PW1	CMA, SD
CMSB	CMB, SW, and SW1	CMB
CMPB	CMB, PW, and PW1	CMB, SD
CMSC	CMC, SW, and SW1	CMC
CMPC	CMC, PW, and PW1	CMC, SD

The OR is equipped with CM3 and SD relays, and CMA, CMB, and CMC relays, if required, which correspond to the above leads and operate from grounds connected through the windings of the CCM relay and normal contact of XR and CSD, as previously described. Cross-connections in the OR cause it to call the CM after 7 digits, in accordance with the basic setting, if no leads are grounded. If the CM3 lead is grounded, this basic setting is cancelled and the CM is called after three digits. Ground connected to one of leads CMA, CMB, or CMC also cancels the basic setting and causes the CM to be called at any other desired points as determined by cross-connections in the OR. Connection of ground to the SD lead alone causes stations delay to be provided in connection with the number of digits required for the basic setting. The SD lead in combination with CMA, CMB, or CMC adds stations delay to the values assigned. The SD lead in combination with CM3 causes a coin to be returned on coin lines.

Relay CCM is provided to check the continuity of lead CM3, CMA, CMB, or CMC on calls requiring one of these leads. Relay CSD is provided to check the continuity of the SD lead on calls requiring it. These relays operate in series with a CM- relay or the SD relay in the MTC upon closure of the paths if the associated leads are continuous through the MTFC and through the windings of the MTC relays to battery.

When the PRT has completed its translation, it operates its HD relay (SFD-K810) which grounds GR and G1T leads and closes battery through its low-resistance HDK relay to the HD lead. The PST relay in the MTC, having been operated from resistance battery, extends this battery and ground through its winding to the HD lead. The HDK relay in the PRT operates to the ground and the GR and G1 relays of the MTC also operate.

Upon operation of the HDK relay (if the pretranslator has been satisfied on its continuity checks of the transmitting leads), it grounds the PRL lead, which is closed through the PST, GR, and G1 relays operated, to operate the PRL relay which locks on both windings and extends ground back to the RLK lead, lights the PRL lamp, provides locking ground for the SD, CM3, CMA, CMB, and CMC relays, and opens the operate circuit of the PST relay which holds to the HD lead.

Upon receiving ground on the RLK lead, the PRT checks that there is now locking ground on the transmitting leads which it had previously grounded.

If the lock check is satisfactory, the HD relay of the PRT releases, opening the G1T, GR, and HD lead to release G1, GR, and PST relays in the MTC which close a path through the PRL relay operated to operate the MFC relay which in turn operates MFC1 relay (SFD-K808).

The MFC1 relay removes battery from the PTP lead, starting the release of the MTFC, and releases the PC1 relay which in turn releases KA, KB, KC, PC2, PC3 relays to disconnect leads to the MTFC.

When the MTFC has restored to normal, it releases the TS relay.

The PTT, PTR, and those lamps of the CM3, SD, CMA, CMB, and CMC group corresponding to the translation remain lighted at the end of the test.

The G1 and GR lamps flash momentarily but are extinguished at the end of the test.

Operation of the RL key operates the KR and KR1 relays which remove locking grounds allowing the release of the circuit.

K8-4 SPECIAL PRETRANSLATOR TEST FEATURES

K8-4.1 CHECK THAT THE PRETRANSLATOR APPLIES AND REMOVES GROUND ON GR AND G1 LEADS

The slow-release SR relay is operated through break of the G1, GR, and PTR1 relays when the PST relay operates. Since the PC1 relay is operated through a make contact of the SR relay, a check is made that SR is operated before the test starts (SFD-K810).

When the HD relay of the PRT operates, it should apply ground to both GR and GLT leads. If either GR or GL relays fail to operate, the operate path for the PRL relay is held open and the SR relay starts to release. Release of the SR extends locking ground for PST, GR, and GL relays to hold whichever are operated and also operates MFC relay to release the connection. It is possible that the work timer of the pretranslator might time out to cause a partial record before the SR relay releases under this condition.

The PTT, HD, and either GR or GL lamps should remain lighted at the end of the test.

If, on an otherwise satisfactory call one or two of the GLT, GR, and HD leads are opened but not all, the MFC relay is prevented from operating until the SR relay releases. When the SR has released, it provides locking circuits for GL, GR, and PST relays to hold up whichever are operated and operates the MFC relay to release the connection. It is possible that the pretranslator may time out and take a partial record before the SR releases under these conditions.

At the end of the test, the PRL, proper SD, CM3, CMA, CMB, and CMC lamps and one or two of the HD, GR, or GL lamps remain lighted.

K8-4.2 OPEN PRL LEAD (PRL KEY OPERATED)

Operating the PRL key (SFD-K810) opens the PRL lead. When the PRT advances to the point of grounding the PRL lead, it blocks because it does not receive ground back on the RLK lead and takes a trouble record which should indicate no RLK. Upon completion of the trouble record, the PRT having determined that neither the PRL nor RLK leads are grounded, grounds the PTR trouble release lead unless it is handling a second trial call (TR2 key operated)(SFD-K810). Ground on the PTR lead operates PTR1 relay in the MTC which starts release of slow-release SR relay and opens the operate path of the PST relay. The PRT should maintain battery on the HD lead and ground on the GLT lead but should open the GR lead. The SR relay, being slow, allows time for the PST, GR, and GL relays to release before closing locking circuits. Upon release of the SR relay, the MFC operates to release the test connection.

The HD, GL, and PTR lamps should remain lighted at the completion of the test. The GR lamp should not be lighted. Some of the SD, CM3, CMA, and CMB or CMC lamps may have lighted during the test but will not remain lighted at the completion of the test because the PRL relay will not have operated to lock them in (SFD-K807).

If the TR2 key (SFD-K810) is operated to simulate second trial, the pretranslator, upon completion of the trouble record, grounds the RLK lead during the operate time of the TRBA and TRL relays of the pretranslator (SFD-K810). The GR lead is opened momentarily then reclosed, and the HD and G1T leads are then opened. Upon operation of the PRL relay in the MTC over the RLK lead, the SR relay starts to release. Release of the SR relay operates the MFC relay to release the connection and provides a locking circuit for the GR relay.

At the end of the test the PRL, GR, and the proper SD, CM3, CMA, CMB, and CMC lamps should remain lighted.

If the TR2 and RLK keys are operated in addition to the PRL key to simulate second trial failure with both PRL and RLK leads open, the test proceeds as described previously except that the PRL relay does not operate. The SR relay starts to release when the HD and G1 relays release.

At the end of the test the GR, and the proper SD, CM3, CMA, CMB, and CMC lamps should remain lighted.

K8-4.3 OPEN RLK LEAD (RLK KEY OPERATED)

Operating the RLK key (SFD-K810) opens the RLK lead. When the PRT advances to the point of grounding the PRL lead, the PRL relay operates but because it cannot return ground on the RLK lead, the PRT blocks and takes a trouble record. Upon completion of the trouble record, operation of the TRB relay of the PTR (SFD-K808) removes ground from the GR lead (SFD-K810). Because there is ground on the PRL lead, the PRL relay of the PTR operates. The TRBA relay of the PTR (SFD-K808) is then operated. The TRBA relay recloses ground to the GR lead and operates the TRL relay which removes ground from the G1T lead. The PTR lead is not grounded. The PST and G1 relays release, starting release of the SR relay. The SR provides a locking circuit for the GR relay.

The PRL, GR, and the proper SD, CM3, CMA, CMB, and CMC lamps should remain lighted at the end of the test. The test should be the same whether the TR2 key is operated or normal.

K8-4.4 OPEN TRANSMITTING LEADS (OT KEY OPERATED)

Operating the OT key prevents the operation of the PC3 relay (SFD-K810) which is the connecting relay for the transmitting leads (SFD-K807). For any code having a translation which would ground one of the transmitting leads (SD, CM3, CMA, CMB, and CMC), the PRT will not detect battery on that lead, will recognize a continuity failure, and will take a trouble record.

With the OT key operated, the test functions, after the trouble record, as previously described for PRL key. The lamps SD, CM3, CMA, CMB, or CMC will not be lighted.

K8-4.5 FAILURE TO RECEIVE LOCKING GROUND ON TRANSMITTING LEADS (LK KEY OPERATED)

Operating the LK key prevents locking any of the relays SD, CM3, CMA, CMB, or CMC. On codes having other than the basic translation; i.e., having translations which require grounding some of the transmitting leads, the pretranslator blocks when it does not detect locking ground returned on those leads, and takes a trouble record. Upon completion of the record, the PRT momentarily opens the GR lead, then having detected ground on the PRL and RLK leads, recloses the GR lead and opens the HD and G1T leads. The PST and G1 relays releasing start the release of the SR relay. The SR relay releasing locks the GR relay and operates the MFC relay to release the connection.

The PRL and GR lamps should remain lighted upon completion of the test. The proper SD, CM3, CMA, CMB, or CMC lamps will light momentarily but will not remain lighted. The test functions the same with TR2 key operated or normal.

K8-4.6 OPEN PTR LEAD (PTR KEY OPERATED)

For this test the TR2 key should be normal and a code having other than a basic translation should be used. One test should be made with the PRL key operated and another with RLK key operated to test that the pretranslator grounds both RLK and PRL leads.

Operating the PTR key opens the PTR lead and also opens the operate path of the PC3 relay to produce an open transmitting lead condition. When the PRT detects this condition, it takes a trouble record, opens the GR lead, and grounds the PTR lead.

The PTR1 relay does not operate, however, because the PTR lead is open. The PRT times out on its TRTR timer, brings in an alarm on the pretranslator frame, and grounds the PRL, RLK, and GR leads and then opens HD, G1T, PRL, and RLK leads. The PRL and GR relays should operate. The PST and G1 relay should release. Release of the PST or G1 relays starts release of the SR relay which operates the MFC relay to release the connection. A make contact of the PTR key prevents release of the SR relay upon release of the GR relay.

At the completion of the test, the GR and PRL lamps should be lighted and there should be an alarm at the PRT.

K8-4.7 CROSSED OR OPEN RECEIVING LEADS (2CD KEY OPERATED)

An older test frame having pushbutton A, B, and C keys, by operating more than one button on the A, B, or C keys, more than 2/5 receiving leads are grounded. If the translations of the code combinations are the same, the PRT will detect no trouble and will return the correct translation to the test frame. If, however, the translations of the code are different, the PRT will detect the cross and take a trouble record, indicating an XX punch and showing which receiving leads are grounded.

To produce a condition giving the maximum resistance path which is normally expected to operate the crossed-receiving lead detection relay, a combination of buttons on the C key (or the 2CD key with the C switch) should be operated to produce codes having translations which ground only two of the cross-connection points BS, CMP3, CMPB, and CMPC or only two of the cross-connection points BS, CMS3, CMSA, CMSB, and CMSC in the pretranslator.

The C leads grounded by C switch with 2CD key operated are shown in Table F.

TABLE F

Position	Normally Grounded	Extra Lead Grounded With 2CD Key Operated
0	4,7	1
1	0,1	4
2	0,2	4
3	1,2	7
4	0,4	7
5	1,4	0
6	2,4	0
7	0,7	2
8	1,7	2
9	2,7	1

If no button is operated on one of the A, B, or C keys or if one of the A, B, or C switches is in the OFF position (so that an incomplete code is received,) the PRT will time out and take a trouble record showing the data received.

K8-4.8 TRANSFER START - TRS KEY

Operating the TRS key simulates a connector transfer start condition by grounding the TRS lead. The PRT functions as it would otherwise except that it takes a trouble record before opening the HD and GLT leads, causing the GR lamp to remain lighted. In service this record would show the pretranslator connector used, but this information is lacking on a test call because no pretranslator connector is used.

